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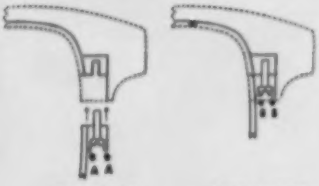

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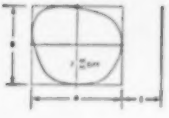

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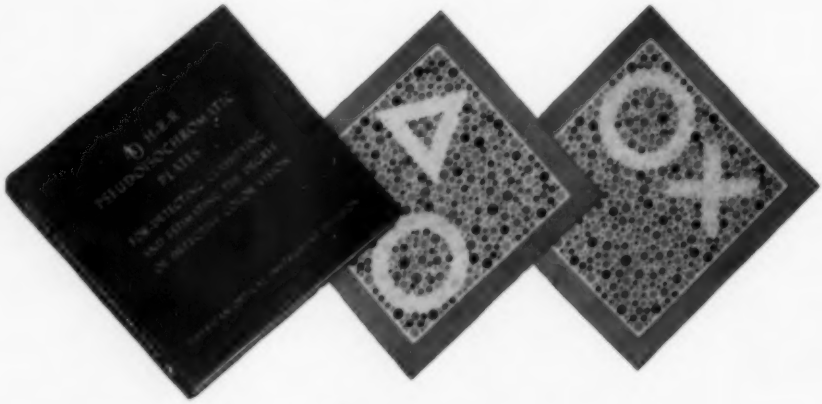

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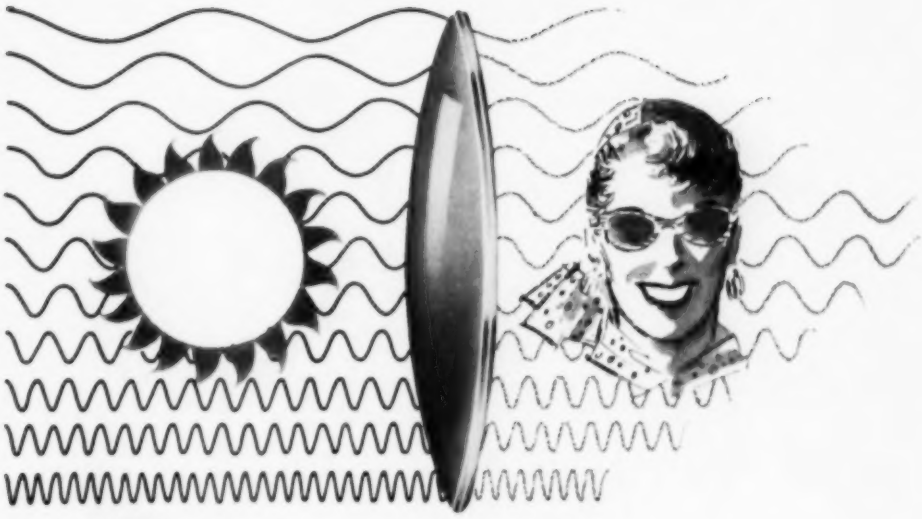

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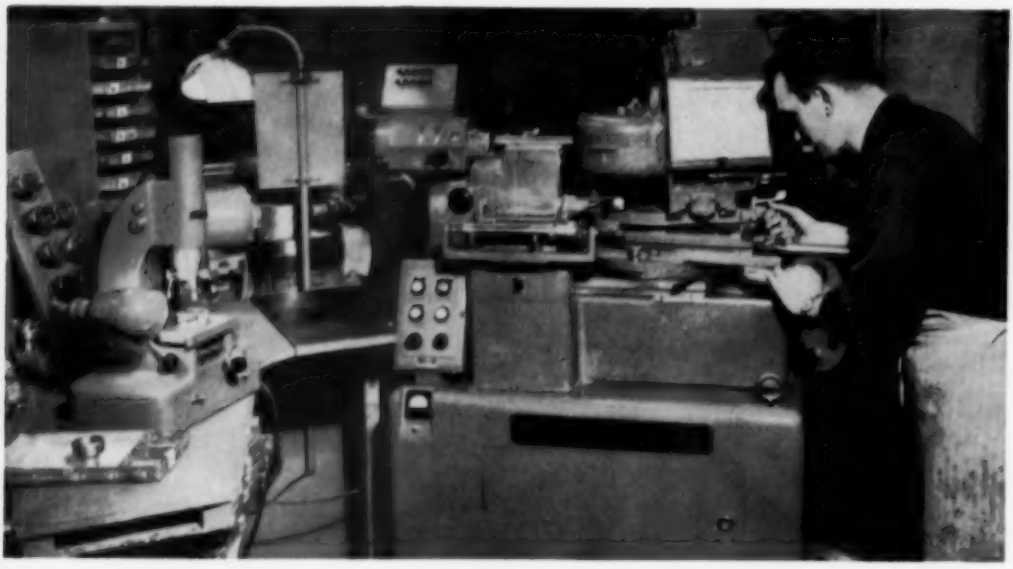

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Vol. 32 May, 1955 No. 5

INSTALLING AND MAINTAINING INDUSTRIAL VISION PROGRAMS*

Richard Feinberg†
Northern Illinois College of Optometry
Chicago, Illinois

Installing a vision program in industry is subject to many variables. Proper evaluation and intelligent handling of these differentiate the outstanding installations from the mediocre and inferior ones. In the successful programs there is a predictive approach to the various factors involved. The goals are set long in advance: the limitations are recognized: the operational approach is utilized to the maximum: the follow-up is thorough. These variables are: 1. Scope of program. 2. Funds available. 3. Number of employees. 4. Size of labor pool. 5. Management-labor relationships. 6. Similarity or diversity of tasks. 7. Precision requirements of jobs. 8. Exposure to hazard in jobs. 9. Quality of employment office staff and procedures. 10. Cooperation of management personnel. 11. Cooperation of medical staff, safety engineer, illumination engineer, public relations staff, and others. 12. Cooperation (and education) of community.

The initiator of an occupational vision plan who is cognizant of these vital factors will be in a much better position to convince management of the values to be derived from an intelligently planned and executed program.

Obviously, supporting all these is the know-how of the individual initiating the program. His integrity, training, experience, imagination, and ability to organize are prime requisites.

Let us consider each of these variables.

1. SCOPE OF PROGRAM. It is of paramount importance that there be clarity of understanding and live communication between the responsible company officials and the one who introduces the program. Otherwise there will be frustration, disappointment and confusion. Every program has given boundaries established by agreement and budget. One cannot go beyond these lines, regardless of wishful thinking, hopeful

*Read before the annual meeting of the American Academy of Optometry, Section on Occupational Optometry, Toronto, Ontario, Canada, December 12, 1954. For publication in the May, 1955, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist, Ph.D., President of College. Fellow, American Academy of Optometry.

ambitions and excess energies. The scope of the program should be as inclusive of detailed planning as is possible. Vague amorphous ideas are not plans.

Items to be considered in the plans of a program may include: Selective placement testing; professional referrals; emergency eye-care; illumination; scientific use of color; protective-corrective eye-wear; economics of the program; education and public relations; and community cooperation.

2. THE FUNDS AVAILABLE. The funds available for vision programs in industry generally are of one of two categories. Either they are new allocations for a specific independent program, or they are budgeted items in an already existing program of which the vision program is a part. In the latter instance, the vision program may be part of a medical, safety, personnel office or training program. In either case it is important to determine the extent of funds available and to budget accordingly. Some factors to be considered in financial allocation are the number of employees involved; whether safety glasses and/or professional services are provided at company expense; the amount necessary for salaries and consultant fees; and, the cost of purchase or rental of equipment. While funds for these items are fixed, demonstrable evidence of success of a program goes a long way in loosening the company's purse strings for further extension of services. Reduction of accidents and loss, increase in production, favorable employee and employer reactions, all tend to broaden the funds available.

3. THE NUMBER OF EMPLOYEES. While union vision care programs mainly make professional services and eye wear available to *all* members free or at a discount, plant programs rarely include all employees except at the selection or placement test level. Classification tests usually are performed either in the personnel office or the medical office, and serve to determine the applicant's visual status for insurance records, to determine his visual skills for the job, and to identify those applicants and employees in need of professional services. If the company is engaged in a program which is essentially a safety glasses program, primarily those who are exposed to eye hazards are included in the materials and services budget. If precision, accuracy and speed are the predominant demands, mainly those working in the departments where these qualities are required, will be included. Unfortunately, the clerical staff generally is overlooked. It is essential to know the number of those who will be included in the program undertaken. This number, depending on the material and services provided, will establish the major costs involved.

4. THE SIZE OF THE LABOR POOL. The size of the labor pool, within loose limits, determines the stringency of all standards maintained in employee selection and placement. For example, in a rural area, tool and die makers may not be as readily hired as in a highly industralized section. Hence, those available may be hired despite their deficiencies. This may imply that more of them will be referred to optometrists and ophthalmologists for best possible seeing than if there were a larger pool available.

5. MANAGEMENT-LABOR RELATIONSHIPS. The size of the labor pool as a factor is further complicated by management-labor relationships, where seniority and closed shop practices may play an important role in employee selection and placement. The unions must be convinced that whatever program is adopted is in the best interests of the employees. If it believes this, the union can be an important cog in the ultimate program success. It is apropos, here, to state that nothing should be done to an employee without his prior knowledge. To win his cooperation, he must understand why a program is of benefit to him. This necessitates selling and re-selling the employee on the value of the program undertaken. Parenthetically, it is frequently necessary to do this with management also. Progress reports are a "must."

6. SIMILARITY OR DIVERSITY OF JOBS. Similarity or diversity of jobs have influence on the varieties of problems presented. Is the work rough labor? Is it mainly a near-point demand? Or is it a wide diffusion of many tasks necessitating departmental handling? How much motility of man power is there? Are employees constantly moving from one task to another, or do they remain in one environment, performing the same task continuously? A diversity of jobs may add to the considerations necessary, but it certainly adds to the professional interest and challenge as well.

7. PRECISION REQUIREMENTS OF JOBS. The demands of near work-point seeing are a challenge to skill and knowledge of the optometrist. Bifocals, trifocals, prisms, loupes, comparators, and other devices are employed as occupational aids to seeing. To properly evaluate the vision demands of a job, a form (see chart) is essential. Good lighting, the proper environment and good machine design are factors not to be overlooked where precision work is necessary.

8. EXPOSURE TO JOB HAZARDS. The extent to which employees are exposed to hazards influences any program greatly. In a hosiery mill, the emphasis is on near-point accuracy and there is no eye protection problem. In a foundry, the emphasis is on eye protection. Nevertheless, visual skills must be considered in every case. Good eye-

sight means limb and life protection. There is an enormous variety of protective eye wear covering most needs. Utilization of machine guards and good lighting is an integral part of any eye protection program. Where these are lacking, eye protection alone is a poor substitute.

ANALYZING VISUAL TASKS

This check list will provide a rough analysis of the nature of visual tasks. Check or Describe:

1. *Job Description.* Use standard job description code number where available.....
   If unobtainable, give title, machine operated or material worked with.....
2. *Work Distances.* Near .....
   Intermediate .....
   Far .....
3. *Central Working Area.*
   a. Size: ..... ft. ..... in.
      Comment: .....
   b. Depth: Gross ..... Fine ..... Flat .....
   c. Motion: Rapid ..... Slow ..... Rotating .....
      Vertical ..... Horizontal ..... Other .....
      Constant ..... Intermittent ..... Fixed .....
   d. Illumination at Work Point: ..... ft. candles or ft. lamberts.
      If not measured: Bright ..... Dim ..... Glare .....
      Comment: .....
4. *Detail for Discrimination.* Fine .....
   Gross .....
   Comment: .....
5. *Visual Attention Required.* Continuous .....
   Intermittent .....
   Casual .....
   Comment: .....
6. *Colors to Be Perceived and Discriminated.*
   a. All colors and shades .....
   b. Blue and yellow .....
   c. None .....
7. *Peripheral Field.*
   a. Area of operation: Large ..... Small .....
      Comment: .....
   b. Illumination: Bright ..... Good ..... Dim .....
   c. Illumination Contrast to Central Working Area:
      High ..... Negative ..... Low .....
      Comment: .....
8. *Hazards.*
   a. Chemical .....
   b. Radiation .....
   c. Physical .....
   d. Protective Eyewear Recommended .....
9. *Unusual Visual Demands.*
10. *Comments.*

Modified by Richard Feinberg, Ph.D., D.O.S., President, Northern Illinois College of Optometry from form in Sight Saving Review, p. 130, Fall, 1948, Volume 18, No. 3.

9. QUALITY OF EMPLOYMENT STAFF AND PROCEDURES. If the employment office staff is an alert one, the possibilities in a good vision

program do not have to be painted on the wall, so to speak. The staff will seek amplification of the salient points of the program. If, on the other hand, the plant is a small one, the employment office staff may consist of one person who came up the "hard way" but who may be totally unfamiliar with good personnel techniques. Dealing with him will be a challenge of diplomacy and education on the part of the initiator of the program.

10. COOPERATION OF MANAGEMENT PERSONNEL. The same comments may pertain to the management personnel as were listed in item nine. In the small plant, in fact, the management personnel is often the employment personnel also. In the larger industries, there may be several plants, each under the leadership of a plant manager. Rightfully, he and his staff have to be sold on the merits of any program. Orders without explanation from a central management above him may open doors, but may not secure proper cooperation. Therefore, the prospective program should be presented to each plant manager and his staff by the proper official of the central organization, together with the initiator where possible.

11. COOPERATION OF INTERESTED PARTIES. Frequently, the vision program is under the direction of the medical officer. Less frequently, it is under the direction of the safety engineer. Sometimes, it is in the training department. In a large plant, regardless of the organization chart, it is vital to secure the cooperation of everyone concerned. The union steward and the industrial nurse often can make the program significantly better because of their close contact with the employees. Securing the cooperation of the medical staff, safety engineer, illumination engineer, nurses, public relations staff, and others interested, profitably could occupy much time and discussion. No one who could help in the development of the program should be overlooked.

12. COOPERATION AND EDUCATION OF THE COMMUNITY. A vision program, properly initiated, will be talked about immediately. The employee will go home and discuss it with his family and neighbors. The professional men in the community rapidly are drawn into the circumference of the circle. Soon everyone is familiar with the program.

As the community becomes more acquainted with good safety practices and good hygenic practices, the plant itself benefits. Therefore, industries often report these occupational vision programs in their house organs in a manner which interests members of the family, as well as the employee. A program, properly conceived, does not eliminate the professional men in the area. It utilizes their services as much

as possible. A good vision program produces the by-products of referrals of the employee's family to the optometrist. The employee, who realizes that he is seeing better and more comfortably, will consider ophthalmic care for his wife and children. Trade schools in the community, following the practices of the industry itself, may adopt a safety glasses program. All of this means happier and more useful workers, housewives, students, and so forth. In other words, the net result is a better informed, happier and more serviceable community.

SUMMARY

A good vision program includes vision testing for placement purposes, protective-corrective eye wear as needed, and a program of visual skill enhancement through eye wear and visual training where indicated. It also includes the consideration of proper environment for seeing. This means good lighting, functional color painting of equipment and walls, and a consideration of equipment and desks from the standpoint of the posture demands placed upon the individual.

The actual initiating of the program may come through an industrial nurse awakened to the visual needs of the employees, a training director, a safety engineer, a medical director, an optometrist, or ophthalmologist, a lighting engineer, or a representative of one of the optical companies. Conferences in which management, professional men and other interested parties engaged in the exploitation of the values of occupational vision programs have done much to stimulate new installations. In professional circles, the sections and committees concerned with occupational vision are doing much to educate the doctors to think in terms of job seeing demands. In the last dozen years miraculous strides have been taken in installing and maintaining industrial vision programs.

For the professional man, nothing takes the place of actually visiting the plant and watching the employees at work. His understanding of the actual job demands becomes translated into prescriptions for corrective eye wear which are specific in design for the specific tasks. To facilitate the evaluation of job seeing demands, the use of the form is suggested. It is recommended that this be completed for each job and that one copy be kept by the doctor, and that another copy be retained by the plant personnel office for reference.

Vision programs are not born of chance. They grow through the accumulated experiences, trials and tribulations of those that preceded.

SOME WAYS OPTOMETRY CAN HELP THE INDUSTRIAL WORKER*

C. Jane Davis†
Occupational Research Center, Bausch & Lomb Optical Company
Rochester, New York

Since July 1952 when the Occupational Research Center was transferred to the Bausch & Lomb plant, we have been collecting data for a broad study of the visual trends of industrial workers. We have brought together records representative of the general industrial population. We have been careful to eliminate poor testing in order to assure accurate data on all tests. The selected population includes over fifteen thousand records from widely varied industries with jobs of many classes. Some of the studies were submitted by industries with a new vision program, others by industries with vision testing programs of long standing. The age and sex distribution is representative of the industrial population as shown in most recent census statistics. This

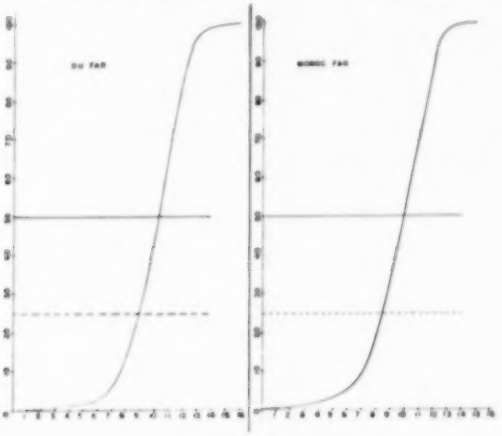

Fig. 1

group of records can be used to predict the performance of the working population with reasonable confidence.

Now let us consider the visual abilities of this "normal popula-

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†B.A., Head, Occupational Research Center.

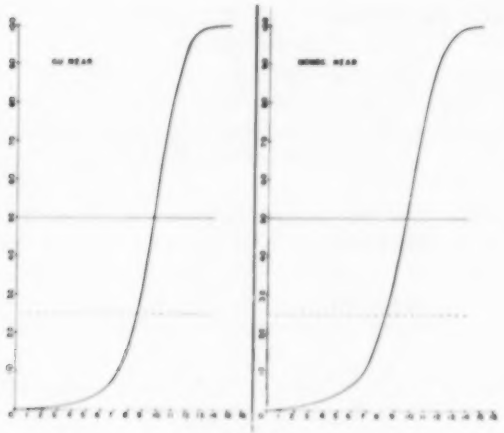

Fig. 2

tion." We can demonstrate the ability in terms of the percentage attaining each Ortho-Rater Score level (Figures 1 and 2). It will be noted that the score of 10 (clinical 20/20) comes close to falling at the 50 percentile level. This means that half of the working population is below this score. Perhaps a more meaningful finding is expressed by the score that would fail the lower 25% of the population. This point falls about the score of 8 on all the acuity tests. In other words, the person who scores 8 has visual ability which is excelled by over 75% of his co-workers.

For the Ortho-Rater industrial standards the maximum score for failure of the O.U. far test is 8. Reference to Figure 1 indicates that by this criterion 14% of the general population would fail the test. The maximum monocular distance requirement is 7 and would fail only about 10%. Similarly at near (Figure 2) the maximum requirement would fail 17% for both eyes and about 12% for monocular. Naturally, the variations in standards and the overlap of failures on the various tests cannot be explained by these graphs. The important point is that the criterion for each test is that the employee not be in the bottom one-sixth of the population on any visual skill. In this light the standards certainly do not appear excessively strict.

When the appropriate visual standards for individual jobs were applied to these records, we found that 25.9% of our sample failed to meet the total standard. Over one-fifth of the failures (or 5.6% of the total group) failed on the basis of one or more acuity scores of 20/50 or lower. This last figure seems rather high since one-eyed workers who had professional eye care during the current year are

not included in this "seriously lowered acuity" category. An additional five per cent of this population had border-line scores suggesting watchful waiting. This group included workers failing only on phorias or with a single acuity score at a questionable level. Normally we suggest a repeat Ortho-Rater test in six months on this group. We found that 45% of the workers passed the standard without the aid of glasses and that an additional 25% passed with glasses prescribed for their use.

When we consider these data with regard to sex we find that 27.1% of the women and 25.3% of the men fall below the standard. This difference probably is not significant. It is interesting to note that 6% of the men and less than 4% of the women had seriously lowered acuity.

Previous similar studies of acuity have indicated that before the age of presbyopia, men have better acuity than women. At about the age of 40 the visual ability of the two sexes is almost equal and after this age, the superiority is slightly in favor of the women. One possible reason is that women are less vain than men. When they begin to have trouble seeing at the near point, they have their eyes examined. When they obtain glasses, they wear them. Men, on the other hand, are reluctant to admit their loss of ability and put off having an eye examination. When they obtain glasses, they have a tendency to keep them at home or in their pocket. Of every 100 people wearing glasses, 60 are women while only 40 are men. It should also be noted that women more frequently perform jobs requiring good near acuity and probably note the first signs of diminished acuity at near more readily than do the men.

When we consider the part presbyopia plays in industry we must consider the failing rate in relation to age. Here we have a highly significant finding. Among workers under the age of 40, 16.4% fail, with one-eighth of these failures showing seriously lowered acuity. In contrast, among workers 40 years of age and older the failing rate is 44.1% and one-fourth of these failures have seriously lowered acuity. The older group has almost three times as many failures and over five times the number with seriously lowered acuity. This indicates that presbyopia is one of the major problems in industry.

Our population is growing older each year. Of course Social Security has cut down the number of workers over 65 but the industrial population is continuing to age. In 1910 less than 25% of the gainfully employed population were over 45. In 1953 this percentage had risen to more than 35%. According to census studies this trend will continue. The above data were figured about the age of 45 since

our census figures were divided in this way. When we interpolate the 35-44 age group we find that 27.4 million individuals age 40 and over were gainfully employed in 1953. In contrast, 30.6 million workers were between the ages of 18 and 39. It is obvious that the visual problems of the older worker require special attention.

Specific job families and the visual performance of each group may now be considered. The highest failing rate is found among the workers in clerical, technical and skilled craft occupations. Production workers showed the lowest rate of failure. Seemingly, workers on an incentive system are more apt to recognize a loss of any skill since they feel it in the pocketbook, a very sensitive area. When their earnings go down, they try to find the reason. Apparently eye care offers a possible solution since many of these workers obtain glasses and wear them on the job even when a vision program is not in force.

Clerical workers and supervisory help are quite slow in recognizing a lack of acuity. Women in this classification showed a failing rate of 39%. This group is composed primarily of young women who are working until they have a family and older women who return to their jobs after their children are grown. Among the younger group we have a large number who fail the distance tests. A large number of these women have glasses which they do not use. The older group in this job category naturally fail on the near point tests. Unfortunately the loss in near point ability is gradual rather than dramatic. Eventually these women experience sufficient difficulty that they do obtain a near point aid.

The highest rate of failure found for any single occupational group was for school teachers, 40% of whom have substandard vision. More than ten per cent have seriously lowered acuity. Many of these teachers wear glasses; however, most of them have not had an eye examination in five years. If the reports to this office are representative there are approximately four hundred thousand public school teachers in this country in need of eye care.

On the low side, we find a large cross country trucking firm with under two per cent failure. This company has had an active vision program for a number of years and screening has been quite complete. Annual Ortho-Rater examinations are run to pick up any workers requiring further eye care. In addition there are relatively few older workers in the group. This large population group averages at least a full point higher than the "normal" trend on all acuity tests. It is difficult to bring a population to this level visually. It is obvious that regular examinations and a strict policy on eye care can do much.

Apparently it is never safe to assume that people know when they need eye care.

From a consideration of the data it is apparent that we are dealing with a large group of workers in need of eye care. We decided to estimate just how large this group was. Unfortunately industrial census data are divided in many ways. We found that we could use an age and sex, or a sex and occupation break, but because of the form of the census figures it was impossible to include all three factors. We tried both methods and results indicate that between seventeen and eighteen million gainfully employed workers probably need eye care today. Almost two-thirds of this group is in the presbyopic ages.

We next analyzed the failures in an effort to gain further information. For the younger group it was found that about 60% of the failures had no glasses and that most of these had never had a professional eye examination. Another 25% had glasses for use at both distance and near. Very few of these had been examined within a year and only a small number within two years. Another 15% had glasses which they wore irregularly or sporadically. The biggest factor here seemed to be the recognition of visual problems.

Among the older workers the problem was quite different. Only 30% had no glasses, but about 12% had single vision glasses and 7% wore glasses irregularly. Thus half of the workers who failed had bifocals or near point glasses. This was surprising since we had suspected that the biggest problem would be failure to recognize the onset of presbyopia. Apparently the failure to recognize the need of a change in the prescription is a problem of even greater magnitude. Glasses were owned by 80% of this group and were reportedly worn regularly by over 60%. Unfortunately many of these glasses were antiques. This situation interested us and we began to watch for clues to the difficulty. The following observations will serve as illustrations:

One large furniture factory had a number of small plants and ran plant-wide testing on each. The failing rate was high—at least 35%—on each of these plants. We decided to go over the material on one plant and search for trends. The study considered had 292 employees who were cutting, assembling and finishing furniture. Most of the work was at near and intermediate distances; however, the physical layout of the factory required good distance vision for safety. Almost half of these workers failed to meet the standards for their jobs. Fifteen per cent had acuity of 20/50 or lower. The experience factor was unusually high and the average age was about 45. Failure was most frequently at the near point.

As we reviewed the material we were struck by these facts. Almost

half of the failures had glasses which were not worn on the job. In some instances the old glasses were used at work. In other cases no glasses were used on the job. Comments on the cards indicated that the workers were protecting their best glasses from the hazards of the job. Perhaps they were justified for we found 28 workers whose records indicated that their glasses were badly out of adjustment. Incidentally these workers were not failed but received notification cards suggesting that they have their glasses straightened before being retested on the Ortho-Rater. There were not too many workers with satisfactory vision. This is quite a problem : a job with hazard to glasses. It seems logical to reason that a job which presents such a hazard to glasses also presents an eye hazard. This is a situation that needs further investigation.

Another company doing fine near point assembly seemed to be very interested in eye care. The Ortho-Rater program was new but they had previously had a Snellen test at 20 feet. Safety glasses were used throughout the plant. Here the average age was about 35; however, many highly skilled employees were over 45. The failing rate was high for the age level of the population involved. We were particularly impressed by the fact that about ten per cent had seriously lowered acuity.

Again we found that those individuals with seriously lowered acuity either had never had an eye examination, had glasses but had not had a professional eye examination during the past three years or had glasses at home for reading. A large number of workers who failed did not have their most recent prescription incorporated in the safety glasses which were used on the job. The biggest problem in this company was the fact that the workers were not benefiting on the job even when recent eye care had been sought. It seemed that "reading glasses" meant glasses for reading—not for the near point work on a job.

A metal industry working mainly with large castings has quite an active program. While the manufactured parts are large, the finish must be perfect in many instances and there is considerably more near point work than is apparent. We found that reading glasses were almost universally kept at home. In addition, many workers with bifocals and single vision lenses prescribed for regular wear did not use these glasses on the job. Safety glasses seldom incorporated the most recent prescription and apparently never included the reading add. This company was having considerable difficulty with their inspection. Most of these inspectors were over 40 and had reading glasses at home.

As this company continued its vision program we found that

workers who previously failed were being retested about six months after obtaining eye care. In most instances these people passed the standard when retested with glasses. An interesting fact came to our attention. Quite a number of these workers had obtained single vision reading glasses and stated that the glasses were still not being used on the job. This is understandable since the worker needed to be able to see clearly at distance for his own protection. In addition we found that a number of workers on one operation were not happy with their bifocals because they had to "back away from their work." Job descriptions showed that these workers had the greatest visual demand at about eight inches. Clearly the glasses should have been designed for the job.

Another industry working with large metal parts presented an unusual problem. Inspection involved viewing distances of ten inches to eight feet. While the inspection was visual there were certain "tricks of the trade"—manipulating the part to catch gleams of light from scratches or signs of the tubes being out of round. The experience factor was high and the average age was over fifty. Of 62 inspectors we found 12 with seriously lowered acuity at the near point. Three of these also had seriously lowered acuity at distance. Four of these failures had never had an eye examination even though they were all over fifty. Seven had been examined over five years previously, and three of these had reading glasses but were not wearing them on the job. Only one of the workers with seriously lowered acuity had been seen by an ophthalmic practitioner as recently as the last three years. This man was 63 years old and was wearing single vision glasses which were quite obviously not the lenses prescribed on the most recent visit.

Twenty-one other workers failed but did not have seriously lowered acuity. Three of these workers were in their late thirties and the rest were over 40. Three failed distance acuity, 13 near and five both far and near. Of this group 12 had never had a professional eye examination, three had recent bifocals or trifocals but wore old glasses on the job, two had near point glasses at home, one had single vision glasses seven years old, one had recent bifocals which were "crooked," one had recent bifocals but failed on one eye at both far and near (this patient was probably not correctible according to note), and one had glasses which he said were for near.

These examples lead to one conclusion. Optometry can be of tremendous assistance to industry. Industry can also provide a large group of patients with real needs. From our work in the Occupational Research Center we would like to summarize some of our findings which may help optometrists in serving industry. Many of these facts are probably

familiar since many optometrists have already faced and solved these problems. It is possible, however, that some points warrant additional emphasis. The following four statements summarize the problem:

1. There are probably 18 million industrial workers who need eye care for comfortable, efficient performance of their jobs. Some of these workers have never had professional eye care. Others have glasses which they do not wear, or wear incorrectly. A large number have glasses which no longer correct their visual problems.

2. Presbyopia is a very real problem in industry especially when we consider that the population is growing older. Since the loss of near point acuity with age is gradual, these older workers often do not recognize the need for a near point aid. Even when they do obtain bifocals or reading glasses, they are not aware of the fact that the prescription is not good for life.

3. Many jobs have more near point demand than is apparent. Several visual working distances exist in some jobs. In many instances unless glasses are fitted to the job, they are not satisfactory and are not used.

4. Sometimes glasses take a beating on the job. Adjustment is seldom made at regular intervals.

There are a number of things optometrists can do to help the problem. The following seven suggestions may prove helpful:

1. Find out as much as possible about the job. Never trust an estimate of a working distance. Sometimes the worker can act out his work and give a better picture of distance and viewing angle. If he is referred by an industry with an Ortho-Rater program information of this type should be furnished on the back of his performance record.

2. Consider the refraction in terms of the job program and prescribe glasses best suited for the job. Naturally, in some instances this automatically points to the need for two pairs of glasses. Strangely enough, people do not seem to dislike the idea of glasses for the job and glasses for other activities. In fact, they seem to recognize the advantage much more than we expected. Every now and then we get a letter from someone who has discovered a "new" idea in glasses. Most of these ideas are quite old but people haven't gotten around to discovering them.

Recently a dentist showed me some "upside down bifocals" and gave quite a lecture on their advantages. He seemed to feel that someone should have discovered them long ago. After complaining continually about the size of his reading segment, and after going through a series ending with a large Ultex segment he conceived the idea of having

glasses made up from two sets of lenses cut in half, which would provide a larger near point field than the Ultex. He presented his idea to his optometrist who didn't break the news that Ben Franklin had thought of the split lens several years ago and that the modern bifocal was an improvement of this. Instead he suggested that he might be able to get something made up to this idea. When the upside down bifocal arrived the dentist was delighted. He's been selling his idea to other dentists ever since. He wears trifocals at other times. He may have invented them too.

Several months ago we had a letter from a middle-aged woman who had made a similar discovery. She frequently typed using a gadget known as a "line-a-time." This consists of a copyholder which is behind the typewriter. The copy is held vertically and is read by looking ahead at eye level. This means that instead of looking downward at copy about 15 inches away, she needed to see straight ahead at about 24 inches. At other times she was doing conventional typing from her shorthand notes at the usual viewing distance. She proceeded to explain the various difficulties she had with reading glasses and the various bifocals. Now it seemed that her doctor figured the whole thing out. He gave her an upside down bifocal, the major portion of which was for near, and was fine when she looked at her notebook. At the top was a segment for the 24 inch distance of the copy holder. She thought it was marvelous and very clever of her doctor to think of it. Whenever she left her desk she put on her conventional bifocals since she had no distance portion in the special glasses. She didn't mind swapping glasses when she went to take dictation. She wrote us about it because she felt other people would like to know about this invention. I think she was right. There are a great many people who would be much happier with some of the less common prescription lenses.

3. Explain proper use of glasses to the patient especially when he gets his first multifocals. Teach him to avoid the problems which his friends have assured him exist. Tell each patient that it is necessary to keep the glasses clean and in good adjutment if he wants to obtain the full value from his prescription. Make certain that he understands that he is to return for help if he does have trouble adjusting to his prescription.

4. See that the patient understands that there is a real necessity for regular eye examinations. This point is particularly important for presbyopes. Explain that the aging process of the eye is continuous and that bifocal prescriptions must be changed as the patient grows older. How frequently do we hear the story of the individual who got

glasses and his eyes got worse. The glasses got stronger and stronger and the terrible thing is that now he can't see without them. We need a great deal of education on this point.

5. When prescribing reading glasses, make certain that the patient realizes that he is to use them for other near point work. On the other hand let him know that he is not to wear them for distance also. We find electrical assemblers wearing distance glasses on the job even when they are 55 years old and have 20/50 vision. They usually have glasses at home for reading but state that they don't read on their jobs—apparently reading must include only a book or a newspaper since most of these people are on jobs requiring the reading of blueprints. We also find the notes "glasses for reading but wears them always." The distance test scores are rather poor on some of these. When we have people with two pairs of glasses, one for distance and one for near it often is obvious that they are being used in reverse. Notes on these records suggest that the patient has a somewhat distorted understanding of his doctor's orders.

6. Make certain that the patient's job does not obviate the use of reading glasses. In some instances a distance section is absolutely necessary for efficient and safe job performance. There are also other advantages in multifocal lenses. Recently, ex-President Truman was quoted as saying he saved fifteen minutes a day by wearing continuous vision trifocals. It seems he wasted time changing his glasses.

7. When prescribing glasses for a single seeing distance or when prescribing "rest glasses," make certain that the patient understands. In the READER'S DIGEST there was a story of three women who came into a restaurant and proceeded to move the menus back and forth in an effort to bring them into focus. Finally all three put on glasses. The first one said, "I only wear mine for reading," the second, "I really need mine for driving." The third said, "I rarely wear mine except when I want to see." We find comments almost this unusual among people failing the Ortho-Rater standards. Glasses for headaches, when people don't feel good and when things look fuzzy are quite common. We even had one note: "Doctor gave her glasses just in case."

To summarize, the problems which arise in industrial vision require considerable thought and effort. If the industries in your areas have vision programs, workers are being notified of their need for eye care. If the vision program includes a good test of near point acuity, more than half of these individuals sent out for eye care will be presbyopes. When these people come to your office you can generally give them the visual abilities needed on their jobs.

A SUMMARY OF STUDIES IN VISION CONDUCTED AT THE NORTH CAROLINA STATE COLLEGE*

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The sponsors for most of the studies summarized in this report were: (1) The North Carolina Department of Motor Vehicles; (2) The North Carolina State Optometric Society.‡

I. RELATIONSHIP OF VISION TO HIGHWAY ACCIDENTS IN NORTH CAROLINA

A. Title: A Comparative Study of the Visual Skills of Accident and Accident-Free Drivers.

Results: a. In general, statistically significant differences were not found in the visual skills between accident and accident-free drivers.

b. In a perfectly matched group (age, sex, race, and mileage) of 43 drivers who had three accidents versus 43 drivers who were accident-free, the following results were obtained:

1) Statistically significant differences in the visual skills of far acuity—right eye, and near acuity—both eyes, were obtained between accident and accident-free drivers, in favor of the accident-free drivers. Differences were found which approached statistical significance for far acuity—both eyes, depth, near acuity—right eye, and the difference between far and near lateral phoria, all in favor of the accident-free driver.

c. In all of these studies, the level of education was higher for the accident-free driver than for the accident drivers. In a few cases, this difference approached statistical significance.

d. In one study, education was controlled by co-variance. This, however, did not disclose any additional difference not shown when education was not controlled.

B. Title: A Comparative Study of the Visual Skills of Responsible and Nonresponsible Accident Drivers.

Results: a. The nonresponsible drivers made significantly higher scores on depth perception (5% level of confidence) than did the responsible drivers.

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*Abridgment of a committee report to the American Academy of Optometry, Section on Occupational Optometry, Toronto, Ontario, Canada, December 12, 1954. For publication in the May, 1955, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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‡Studies done by the Department of Psychology, North Carolina State College, Raleigh, North Carolina, 1938-1953. Most of this work was done under the general direction of J. D. Moffie, Ph.D.

b. The nonresponsible drivers made more favorable near lateral phoria scores (significant at 5% level); the responsible drivers tended to be slightly exophoric.

c. The nonresponsible drivers had a higher educational level than the responsible drivers (1% level of confidence).

C. *Title:* The Relationship of Driving Vision to Age for North Carolina Motor Vehicle Drivers.

Results: a. The near acuity visual skills showed their greatest change with age of all visual measures taken on the Ortho-Rater. These near skills remain fairly constant up to the age of 40, drop sharply between 40 and 50, and show little further deterioration afterwards.

b. Although the far acuities are not affected as much by age as the near acuities, the change is nevertheless very pronounced. In contrast to the near acuities, there is no sharp decrease between 40 and 50, but a slow, gradual decline throughout the years.

c. Both far and near vertical phoria show little variation up to age sixty-one. Afterwards there is a slight tendency for drivers to become right-hyperphoric for distance and left-hyperphoric at the near point. A correlation of .65 was obtained between these two skills.

d. On lateral far phoria, drivers tend to become slightly esophoric up to the age of 60, after which the trend is reversed tending toward orthophoria again. On lateral near phoria, drivers become increasingly exophoric after 50 years of age. Far and near lateral phoria correlated .24 with each other.

e. Depth perception for the average driver remains constant up to age 50 and declines after this age. Depth correlated .36 and .25, respectively, with far and near acuity, both eyes.

f. Color vision remains fairly constant, showing only a slight decline with age.

D. *Title:* Distributions of Ortho-Rater Vision Scores for the Sex-Race Groups Comprising North Carolina Motor Vehicle Drivers.

Results: a. Male-colored drivers made generally higher scores on the far acuity skills; these differences were not all statistically significant, however. In contrast, the white-female group consistently had the lowest mean scores.

b. The female-colored and male-colored, especially the latter, have more imbalance on the phorias, both near and far.

c. No significant differences were found between any of the groups on depth.

E. *Title:* A Preliminary Study of Types of Accidents as They Relate to Vision.

Results: A. Of the seven accident classifications considered, only

intersectional—entering at an angle accidents indicated that there was a significant difference in the visual capacities of drivers incurring night and day accidents. The differences in far vertical phoria, degree, and far acuity, right eye were significant at the 5% level of confidence; color vision was significant at the 1% level.

b. When all types of accidents were combined into groups, day and night, the differences in mean age and far acuity right eye, were significant at the 1% level of confidence. Age was a significant factor in only one type of accident, opposite direction head-on and sideswipes, when the accidents were considered separately.

c. When the types of accidents were compared with each other, day and night accidents being combined, significant differences were found on age for seven out of the 21 comparisons made.

d. Trends in the comparison of types of accidents indicate that higher suppression scores are associated with intersectional accidents; same direction—rear end and intersectional accidents are characterized by lower depth scores; sideswipe, leaving the roadway and overturn accidents are accompanied by higher far lateral phoria scores than any other types of accidents.

II. VISION AND INDUSTRIAL EFFICIENCY

A. *Title:* The Relationship Between Ortho-Rater Test Scores and Termination of Workers in a North Carolina Cotton Mill.

Results: a. Two groups of workers, 80 "terminators" and 90 "nonterminators" were compared on their scores obtained from an Ortho-Rater test. The "t" scores indicated statistical significance for the means of far distance both eyes acuity and far distance left eye acuity scores, but when the age factor was adjusted through the use of analysis of co-variance, no difference appeared to exist.

B. *Title:* The Relationship of Visual Skills to Frequency and Cause of Voluntary Health Clinic Visits in a North Carolina Textile Mill.

Results: a. A population of 469 employees, who were employed during the entire period of one year and five months, was investigated to determine if there were any relationships of visual skills to frequency and cause of voluntary health clinic visits in a large North Carolina textile mill. When frequency and cause of health clinic visits were varied, and mean scores were computed for each of the twelve visual tests in the Ortho-Rater, no trends were noted.

C. *Title:* The Relationship Between Various Aspects of Vision and Production of Sewing Machine Operators in a North Carolina Textile Mill.

Results: a. The relationship between various aspects of vision,

as measured by the Ortho-Rater, and production of 81 female sewing machine operators was investigated by means of various statistical methods. For the most part, no relationship was found between vision and production for these sewing machine operators. It was concluded that these workers probably relied most heavily on tactual rather than visual cues on this sheet sewing operation.

D. Title: The Effect of Corrective Lenses Fitted at Working Distance Upon the Productive Efficiency of Hosiery Loopers.

Results: a. 40 female hosiery loopers were matched as to hourly rate of production and placed into two groups of 20 each. After all loopers had been given a complete eye examination, members of one group were fitted with corrective glasses designed to bring the near point looping more within the normal range of human adaptability in the hope of improving productive ability. After wearing these glasses for a period of 20 weeks, the second group, as well, was fitted with special corrective glasses, which they wore at work for 20 weeks. Mean changes in hourly production rates of about 2% show trends favoring the hypothesis that the wearing of special corrective glasses to meet the visual demands of the job will increase productive ability, but "t" ratios testing the statistical significance of mean changes between groups do not indicate any differences beyond chance probability. The professed subjective feelings of the loopers themselves and of the plant management personnel seem generally in favor of such an eye care program.

III. VISION IN THE SCHOOLS

A. Title: The Relationship of Ortho-Rater Depth Scores with Certain Personality Factors.

Results: a. No statistically significant relationship between scores on personality and depth tests was demonstrable. A slight consistent positive relationship, indicating some slight tendency for better adjusted subjects to do better on depth scores, was noted.

B. Title: A Five-Year Study of Developmental Trends in Visual Skills, Personality Adjustment, and School Achievement of Public School Children.

Results: The study is at present in its third year. Preliminary analysis of a small part of the data has been made. The per cent of students with normal far point acuity declines markedly with grade, while the per cent with normal near acuity increases. There is no obvious relation between intelligence, personality, and vision test scores.

C. Title: The Relationship Between Visual Training and Reading, and Academic Improvement.

Results: a. The visual training group made significant, lasting gains in reading ability, not matched by either of the other groups. Other measurements showed no significant changes*

D. Title: The Effects of a Course of Visual Training Upon Visual Skills.

Results: Sixty-five college students who served as subjects in an experiment on the effects of visual training on an optometric refraction —21 point refractions were given before and after half the subjects received an eight week program in visual training planned by an optometrist. Significant changes in the optometric refraction findings did not occur.

IV. VISION AND ATHLETICS

Title: The Relationship Between Depth Perception and Other Visual Skills, and Basketball Playing Performance.

Results: a. Varsity players had wider visual skills and generally better stereopsis than controls.

V. VISUAL TRAINING RESEARCH

A. Title: Visual Training and Improvement of Reading.

Results: a. The mean improvement for the experimental group, following the training was as follows: Rate, 76.84 words per minute; Comprehension, 5.39 per cent; and Tachistoscopic Training, 29.16. A before-and-after statistical analysis of the reading rate, comprehension, and tachistoscopic training shows that the gain in each of these categories is significant beyond the 0.1% level of confidence.

B. Title: The Relationship of Tachistoscopic Training and Improvement of Reading for Industrial Personnel.

Results: a. At this time, no statistical analysis of the data has been made. It can be reported that the mean improvement in reading rate for fifteen engineers was 74.60 words per minute, while the mean comprehension score shows a loss of 0.27.

VI. NEW AREAS OF RESEARCH IN VISION

The following problems are in the preliminary or planning stages:

A. Title: The Use of Polaroid to Minimize Headlight Glare in Automobiles.

B. Title: The Visual Inspection of Cloth in a Textile Mill.

C. Title: The Visual Dysfunction in Progressive Myopia.

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*This report was published in the Am. J. Optom. & Arch. Am. Acad. Optom. 30.1.3-14.1953.

NOTE: The above summaries are condensed from a mimeographed copy of "Summary of Studies in Vision Conducted in the Department of Psychology, North Carolina State College—1938-53," February 1, 1954. Rather than accept this condensation as being complete and accurate, those interested should consult the original sources in order to avoid possible misinterpretation.

AN OPTOMETRIC SERVICE IN THE FIELD OF AUTOMOBILE DRIVING*

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"More lost time and fatal accidents happen to employees on their way to and from work than happen to them in the plant. It was hard for me to realize that this situation exists until I began digging for information."

Don Mumford, Killing Link

The problem of safe automobile driving is of very real concern to every management and to practically every individual. Unfortunately, many managements are not aware of the effect of automobile accidents on their company.

Every industrial employee is either a driver, a passenger or a pedestrian. Many employees drive many thousands of miles in the course of their employment as salesmen, deliverymen or truck drivers. A company is affected directly whenever one of its employees injures or kills himself while going to or from work, while driving on the job or while out for a pleasure drive over the weekend.

The National Safety Council in the October, 1954, Textile Section Safety News Letter, reports that "an alarming percentage of occupational fatalities result from traffic accidents. In New York State, 20% of all *occupational* death in recent years resulted from vehicle accidents. For Minnesota the figure was 24%; for California, 29%, in Wisconsin, a five year study of occupational fatalities revealed that an average of nearly 38% were due to vehicle accidents."

One large company found that for every person killed in the plant, twenty were killed while driving to and from their jobs. Another company estimates that in 1953, nine traffic accidents took a toll of 132 working days and $3,300 in wages. One firm estimated that the average direct cost of its traffic accidents was $55.00 per case, while the indirect (non insurable) cost amounted to $570.00.

Mr. Ray Welch, who handles accident compensation and insurance programs, and Mr. J. M. Davis, Safety Directors at Bausch & Lomb, estimate that the above figures are too conservative in their company. They report that an average of more than one person each day is out

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of work, losing wages, because of automobile injuries. At one period during March, 1954, three employees were hospitalized at one time with broken legs suffered in three separate accidents.

Many managements of industrial firms are now very effectively promoting accident prevention within the plant. If they would put the same organized effort into a campaign to improve the safe driving record of their employees, they could get to the roots of a very serious problem. They would find many direct and indirect benefits.

We, in this paper, wish to propose a somewhat new approach to desirable optometric services which we believe can be effective in at least four ways:

1. In teaching employees who are drivers of automobiles to use their seeing abilities more effectively for safer operation of their cars. In addition to industrial implications, it is a much needed public service.
2. In enhancing appreciation of optometric services with a very important segment of the public.
3. As a card of introduction to open industrial and commercial doors so that optometrists can render more of their urgently needed services in the improvement and maintenance of vision.
4. In creating a greater awareness in the public mind of the growing important of vision to our every occupation.

It is not my purpose to dwell on factual or assumed relationship between our measureable seeing skills and safe driving of motor vehicles. Instead, the idea I am presenting can be used as the theme for optometric lectures before lay groups. It is, "How to *use* our seeing abilities so as to avoid automobile accidents."

My hypotheses are based on (1) my personal observations during more than 700,000 miles of personal driving during a 14-year period, (2) my discussions with many workers in the field of motor vehicle driving research and (3) evidence gleaned from many published reports.

I am convinced that the public needs instruction in *how* to see while driving an automobile. For example, the novice or one who drives infrequently has a tendency to restrict his visual awareness to: (a) the approaching car, or (b) to the white traffic line, or (c) to the bumper or tail lights of the car ahead rather than maintaining comprehensive seeing. This is particularly true after dark. Too many drivers, both new and experienced, stare at the approaching headlights rather than keeping principal attention on the edge of the road ahead of them. Such individuals need instruction in *how* to see and *what* to look for while driving.

We tell ourselves that most accidents happen because of unfavor-

able driving conditions or because of reckless or drunken drivers. We casually repeat that the answers to automobile accidents lie in better attitudes of drivers, more caution, better highways, less speed, better brakes or more acceleration. It is disconcerting, however, to look at the statistics and discover that:

(1) A high percentage of accidents happen on good straight roads in clear, dry weather.

(2) Most accidents happen to well intentioned, sober individuals who use considerable caution.

(3) When we confine accidents to fatalities, one-third of the drivers were traveling under 55 miles per hour. Speed may not be a major *cause* of accidents, but it does add greatly to the fatalities when trouble comes.

It is my belief that optometry has an opportunity for extension of its services, as well as an obligation to society to step into this tragic picture and do something to teach the honest, cautious, conservative majority of our drivers, *how to use their eyes and how to see* while driving. The handling of the wheel, the throttle and the brakes is a mechanical problem. Probably it is a subject which should be taught by others. The design of highways and their traffic controls and their markings is probably a job for others with the cooperation of optometry. The indoctrination of proper attitudes may be the responsibility of parents and schools. Licensing of drivers is assumed by the various state governments. Seeing, the ability to see, how to see, and what to look for are at once an opportunity for and may well be the responsibility of the "seeing" professions.

Harold L. Smith, in his article, "*What's Wrong With the Careful Driver*," has given seven rules, which, according to him, can make an accident-free driver out of the cautious driver. Five of his seven rules deal with seeing. The two which deal with the mechanics of driving are: 1. Make your car blend smoothly into the flow of traffic, and 2. Master the machine: learn how to control your car under any emergency condition.

The five rules dealing with seeing are: 1. "Aim High": watch out for traffic hazards at least half a block ahead in town, half a mile ahead in country driving.

2. Steer at your target—the center of your driving path.
3. Force your eyes to keep moving.
4. Catch the eyes of people who may threaten your driving path.
5. Never drive blindly.

We are listing eight additional rules which have been gathered

from fact and observation and which in my opinion should be added to the five seeing rules of Smith.

1. See easily at instrument panel distance. If bifocals are necessary for this function, wear them.

2. Be sure you have the functional visual ability to recognize instantly whether or not the driver or a pedestrian is preparing to cross or come into the path of your car. Does he recognize your presence and intentions? Seeing that a car or person is there is not sufficient. See well enough to discern instantly, to see the whites of their eyes as it were, so as to know that they are aware of you. Inefficient eyes may see the blur of the pedestrian or of the other driver, but they do not perceive the glance of recognition from the other fellow, nor do they perceive readily the irregularities of the oncoming driver who may be drowsy or have some other conditions which is causing erratic driving.

3. Be sure that your visual functioning is such that you do not become drowsy unduly soon.

4. While driving against strong reflected glare or the direct light of the sun, wear suitable lenses to reduce the undesirable effects of unwanted light, or use suitable visors to minimize it.

5. Glance in your rear view mirror at frequent intervals to be constantly aware of the intentions of drivers behind you or to the side of you. This is a part of your job of being aware of what is ahead, to the side, and behind you.

6. Develop agile, skillful, comprehensive seeing as opposed to simple acuity.

7. Be sure you see before you act. Some drivers swerve first and then, if they are still able, they will look.

8. Feel the condition of the road with your seeing. Skillful eyes usually can detect slippery or other unsafe spots before the car is on them. It has been poetically stated that "we feel with our eyes." Let us feel the condition of the road ahead of us with our eyes.

There are many other factors in safe and efficient driving—in addition to seeing—but seeing is something which can be improved so readily in most cases. It is a direct, positive approach. The art of adequate seeing is a basic ingredient in safe and efficient driving. Optometry has many opportunities for greatly needed public service in the motor driving field.

The following are specific things which optometrists can do:

1. Industrial and commercial plants who want their employees to get to the job and home again without injury, trucking and other

transportation companies such as public utilities, communications, bakeries, and others with fleets of cars, trucks or buses, schools and service clubs, all can be interested in a down to earth story on "The Art of Seeing as a Factor in Staying Alive," or "Safe Driving Through Skillful Seeing." The public needs this information. Furthermore, our patients are pedestrians and drivers. Let's keep them alive, prosperous and on the active list.

2. We can help the cause of accident free driving by showing the fallacy of the argument—"20/100 is all that is necessary to drive a car." "I have a patient, an old timer, who has no better than 20/100. He has driven for 20 years and has never had an accident." This may be true, but no one knows how many accidents he might have *caused*. Facts show that the betting odds are against him being a safe driver, even though he may be a very cautious one.

3. We can counsel our patients on the desirable use of vision in safe driving. We can provide educational brochures to be picked up in the office or distributed with bills or correspondence.

4. We can recommend vision adequate for the occupation. Bifocals can be recommended for the presbyopic driver so that he can scan his instrument dials effortlessly and instantly.

5. We can recommend speed-of-recognition and other visual training for groups of drivers or for individuals.

6. We can recommend adequate glare protection for daytime driving.

From such a concept we can anticipate: An enhancement of public esteem for optometry and the opening of doors for other professional services.

RESULTS OF BETTER LIGHTING IN INDUSTRY*

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Many attempts have been made to determine the economic results of providing better lighting for better seeing in industrial and office areas. Too often the results have been rather inconclusive because many factors were not adequately controlled. Thus, the desired results and benefits were pretty well masked.

Perhaps one of the outstanding surveys was conducted some years ago at the Uxbridge Worsted Company in Macon, Georgia. Over a period of seven years the lighting was progressively increased in steps from 16 to 70 footcandles. Proper attention also was paid to other environmental aspects of light and lighting such as wall reflections, fixture brightnesses, etc. During this period production increased 10.5 per cent and mending costs—which were of greatest importance to the company—decreased about 60 per cent. Each increase in lighting level resulted in a production increase and mending cost decrease. My understanding is that at present another increase in illumination level is being made and further benefits are expected.

A few other instances of such results when the lighting is improved are:

a. In a machine shop when the average illumination was increased from 15 to 75 footcandles, rejects dropped from 17 per cent to 9 per cent. At the same time production increased from 4.7 units per man-hour to 6.3 units.

b. A rubber products manufacturer obtained 25 per cent less spoilage for overall production after the plant was relighted.

c. In final assembly work in which the operators had to work with very thin metal spacers, improved lighting of 120 footcandles cut rejects 90 per cent and improved the hourly production rate.

Regarding safety, which is an extremely important problem in many industrial operations, similar results have been found. For example, the Allis-Chalmers Company relighted its erection shop, increasing the illumination from 5 to 20 footcandles. This was the first step in a planned program. Accidents were reduced by 32 per cent.

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As a second step in their program, the area was repainted in light colors and the accident rate was cut another 11 per cent. This is considered a very significant improvement.

Unfortunately, there aren't too many other qualitative results obtainable. However, invariably the reports from managers and supervisors reveal that improved lighting has contributed materially to improved efficiency and decreased accidents. Another less tangible result is improved employee morale. This generally results in smaller labor turnover which, in turn, means fewer new employees have to be trained every year. The net result, of course, is maintenance of a high output per man.

In offices there have been some studies reported. Our government is interested in improving working conditions in many of its offices, but before embarking on any large-scale improvement in lighting, several surveys were conducted with experimental conditions to see what benefits could be obtained. A two-year study was made in the Office of the Bureau of Internal Revenue. The entire area was improved by means of light and paint. The original conditions were pretty bad. An added feature of this study was that the eyesight of the employees was tested and glasses furnished to all who needed them. During the test—in spite of some of the income tax forms being made more difficult—there was an improvement of 5.5 per cent. If the task had not been made more difficult, it was estimated that the actual increase of work output would have been of the order of 20 or 25 per cent, but considering the improvement of 5.5 per cent in terms of the annual payroll, it was found that the annual saving was more than twice the cost of relighting and repainting the entire area. Another way of saying this is that this was a 200 per centum return of their investment.

The Post Office Department in Richmond, Virginia, conducted a survey of the effects of improved lighting. The initial lighting was very poor and had very low levels of illumination from rather glaring enclosing globes. The improved lighting was well designed, many areas were repainted, the illumination level was about 45 footcandles of well diffused, glare-free lighting. The first-year increase in production per man-hour amounted to 2 per cent, but the increase at the end of two years was 8 per cent over the original rate of working. Increased comfort for employees, reduced eye fatigue and eyestrain, and a safer, more healthy working environment have reduced errors and increased employee efficiency.

THE VARIATION OF VISUAL CHARACTERISTICS IN SCHOOL CHILDREN AS MEASURED BY THE ORTHO-RATER*

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When we think of visual problems we all seem to tend to one inconsistency. We start too late. Our main attention is directed to the adult—the wage earner. We consider the problems of near point jobs and give special attention to presbyopia. The visual tasks of radio assemblers, crane operators, hosiery loopers, auto drivers, electronic workers and airplane pilots have been studied adequately and we are making excellent progress in the industrial field.

Additional emphasis has been centered on this large segment of the population as a result of studies at our Occupational Research Center. Many articles have been published regarding increased production and safety as the result of adequate eye care. It has been proved that glasses and eye care have a dollar and cents value to the worker and to the industry. Frequently the results of these studies have been quite dramatic.

Unfortunately, similar studies relating vision and school success have been far from satisfactory. While reading is unquestionably a visual task, a relationship between vision and reading ability is difficult to demonstrate. Strangely enough, it seems that this absence of a statistical trend has been taken to heart. The value of eye tests among the school population has never been strongly emphasized. Since these children will eventually become workers, it is difficult to understand the situation.

The schools of today are emphasizing the importance of health programs. Pre-school physicals are routine in many parts of the country. Additional examinations during the elementary and high school years are also frequently a part of the school health programs. Naturally, we are all in favor of this phase of preventive medicine. Infected tonsils, herniae and abnormal weight are brought to the parents' attention.

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Early corrections are recommended and generally followed. Our school children are healthier and happier.

It is interesting to note that this improvement in health has not resulted in increased scholastic ability. Acutally our standards of education have dropped if we are to believe the articles published in our magazines. Only recently the LADIES' HOME JOURNAL devoted an entire edition to the lowered education levels of our schools. It is interesting to note that they report that failure to learn to read is strongly associated with one handicap. Approximately 94% have either never learned (or have never been taught) to associate sounds with letters of the alphabet. There has been little to indicate that any one factor of physical well-being is strongly associated with the ability to learn. In spite of this fact, we continue to emphasize the value of school health programs; for we recognize the intrinsic importance of health.

Strangely enough, the testing of vision has received a minimum of attention considering the importance of our ability to see. Thacker[9] has stated that 83% of our perception is through vision and learning comes through perception. Vision has been proved important on many jobs. Much of our simple enjoyment of life is derived from vision. Why then, has this factor been allowed to play a minor role in the school health examination?

It is true that statistical studies correlating vision and reading ability have been rather disappointing. It seems perfectly natural to assume that a relationship exists. After all, reading requires vision if you are not using Braille. Nevertheless, we find that reading ability and acuity are not strongly linked. Even if we stop at this point, it does not seem advisable to eliminate the testing of vision. I doubt that a hernia repair increases the child's classroom ability, but the school physicians continue to feel that repair should be made. Anything that helps prepare a child for adult life is a part of education.

Now vision has not been entirely overlooked in the schools. A wall chart test is fairly routine in many schools. Of course, this is measuring only the ability to see at distance. No testing is usually done at the near point in spite of the fact that a large portion of the school education is based on reading. However, assuming that testing has been done at 20 feet in most schools for a number of years, we must conclude that testing has certainly not led to correction of the distance visual problems of school children. Many studies lead to this conclusion.

Back in the twenties, the U. S. Public Health Service ran a number of surveys in school vision. In 1924, Collins[2] reports on over 9,000 school children with more than one-fourth showing low distance vision.

Only one-tenth of the children with distance acuity of 20/40 or lower were wearing glasses and only 22% of the children with acuity below 20/67 were wearing glasses. It is interesting that this study also indicated that distance acuity problems were found more frequently in girls; however, this finding was compensated by the fact that girls were more frequently corrected.

In 1928, another Public Health Survey reported by Kempf,[5] resulted in similar findings. Apparently the original survey had little effect for the percentages had not changed. In 1944, Gover and Yankey[4] ran a study in rural areas and found the problem still more acute among farm children. Numerous studies run over a period of years emphasized the fact that we were not doing enough to locate children with visual defects. Some of these studies were based simply on wall charts, others included a total refraction, sometimes with a cycloplegic, but all omitted the near point tests.

Perhaps the findings in the colleges and universities are more serious. In 1936, Boynton[1] reported on vision among college students. She found that 18.2% had uncorrected acuity of 20/50 or less. She also reported an average loss in acuity of 5.7% during the four college years.

In 1939, Thacker[9] examined 9,665 male students at the University of Illinois and found that over one-third had lowered distance acuity. There was evidence that good students had an increase in refractive error during their college stay. Among students with glasses, he came to the conclusion that yearly refraction was desirable since more than 60% of those examined yearly needed a lens change. In this study, myopia was the greatest single problem.

In 1951, Parnell[8] made a similar study of students at Oxford. He found the average acuity of these men below the general population of the same age. He also stated that "vision deteriorates with each school year." This gives evidence that the problem is not limited to the United States.

Another proof that visual defects are not corrected adequately during school years is the high rate of eye failure among inductees during World War II. McDonald[7] reports on examination of recruits at Great Lakes that 21.4% had defective vision. Glover and Brewer[3] found 21.4% failure in 20,000 men examined at the Altoona Induction Center. Theodore[10] reported on over 190 thousand recently inducted soldiers at Miami Beach. He found that 5.5% had vision which *could not be improved to 20/40* and that the cause was organic in less than one-fourth of these cases. When we consider that these examples are from youthful populations previously grossly screened by pre-induction physical, the figures are over-whelming.

Our own experience with industrial studies also points to the needs of further visual attention in schools. We find that the failing rate among the youngest group of workers is remarkably high. In one group of female office workers, we found over half had uncorrected low acuity. All of these girls had been out of school less than two years. In 1941, during a discussion on visual defects in industry, Dr. Hedwig Kuhn[6] commented on the importance of lessening the ultimate number of defects among adults by correcting children. This seems to be a point worthy of consideration. We need to locate children with visual problems. Regardless of the effect on scholastic achievement, subnormal vision needs to be corrected as early as possible. At the same time, we should not close our eyes to the fact that school work itself seems to be contributing to the problem. We should encourage research by other professions on the extraneous factors which are increasing visual difficulties during the school years.

While the Bausch & Lomb Ortho-Rater was designed for testing the visual abilities of industrial workers, it adapted itself well for the testing of school children. The tests were readily understood by children and imposed no literacy requirements. It seemed natural that the instrument should gradually find its place in the school testing program. The question that arose almost immediately was how to decide on a standard for referral. We could not follow our industrial procedure of statistical correlation between vision and job success. In this case, we were dealing with something broader than vision for a specific job. After all, a child has more than one job. He must amass a basic education, learn to participate in group play and gradually build up the abilities to earn a living. Measures of school success must be all-inclusive, covering the mental, social and physical growth of the child. It is almost impossible to bring this information into a single rating which permits correlation. For this reason, no definite school standard was set up when the Ortho-Rater tests were first used in the schools. Actually the derivation of school standards was only recently completed. You may be interested in the thought and research which went into these standards.

Since several school systems had begun to use the Ortho-Rater tests and were sending data to the Occupational Research Center at Purdue, it was necessary to set up a stop-gap standard. Dr. Kephart suggested that the basic standard which he had set up for clerical workers should be satisfactory because of the similarity in the working situation of students and clerical workers. While this selection was logical, the failing rate was rather high and it became evident that the requirements were too strict for the lower grades. For this reason, grades one through

four were processed to the basic health standard (20/50 or lower on any acuity test constituted failure).

In the meantime, research on school vision was going on at the University of Chicago and the Bausch & Lomb plant. As results were amassed, it became apparent that the clerical standard was over-emphatic on some skills and too lenient on others. Failures seemed to be predominantly on one or two tests. The correlation between these test scores and the various data on school performance gave no evidence of a strong relationship. In fact, it became increasingly evident that there was no reason to expect a single factor of vision to be outstanding in school success. The studies suggested that the most satisfactory standard would be one that gave equal emphasis to each of the visual skills measured by the Ortho-Rater. This would result in a general improvement in vision of our future working population.

The University of Chicago Elementary School Standard (Table 1) was set up on this basis. It was designed to fail the lowest 10 to 15% on each individual test on the theory that it is always a handicap to be excelled by 90% of the population on any skill. The standard was set on the visual performance of "selected average" schools for grades four through eight. Naturally it needed to be tested on a more general population.

Table 1
ORTHO-RATER TEST VISUAL STANDARDS FOR SCHOOLS

DISTANCE TESTS	PASSING RANGE		
	Elementary	*High School*	*College*
Vertical Phoria	1Δ R to 1Δ L. Hyperphoria	1Δ R to 1Δ L. Hyperphoria	1.5Δ R to 1.5Δ L. Hyperphoria
Lateral Phoria	5Δeso to 3Δexo	6Δeso to 4Δexo	6Δeso to 5Δexo
O. U.	20/25 or better	20/25 or better	20/25 or better
Worse Eye	20/33 or better	20/29 or better	20/29 or better
Depth (Shepherd Fry Scale)	17.8% or better	56.6% or better	76.5% or better
NEAR TESTS			
O. U.	20/22 or better	20/22 or better	20/22 or better
Worse Eye	20/29 or better	20/25 or better	20/25 or better
Vertical Phoria	1Δ R to 1Δ L. Hyperphoria	1Δ R to 1Δ L. Hyperphoria	1.5Δ R to 1.5Δ L. Hyperphoria
Lateral Phoria	3Δeso to 10Δexo	4Δeso to 11.5Δexo	4Δeso to 13Δexo

About this time the Occupational Research Center was transferred to the Bausch & Lomb plant. Since we were particularly interested in school testing at that time, we immediately pulled all school studies run during the past few years at Purdue (amounting to some 60,000 record cards). Since the University of Chicago studies were run on a single locality, a validation against a broader population was desirable. All elementary school records were reprocessed to the new standard and

we found that the suggested cutting scores actually resulted in the expected failing rate for each test. Again we omitted grades one through three since little testing had been done on this group.

Records on high school students were then similarly analyzed and we found that certain adjustments needed to be made for the same selectivity. A separate high school standard was designed for this population.

Now when we came to students of the college level, we found our populations were extremely select, consisting almost exclusively of Freshmen Psychology students. Because of the G. I. Bill of Rights we had quite a broad age variation but the population could not be considered as a broad sample. Since we had a fairly large population in spite of its narrow spread, it did seem worthwhile to run scatters. We found that this group followed the trend of our clerical standard. That is, the shape of the profile was correct. However, the entire standard needed to be about three quarters of a score point lower. This seemed to be in line with previous findings suggesting that the college population had acuities below the average for the same age level of the general population. At this point, it seemed unnecessary to proceed with a further college survey. After all, these students were rapidly approaching the working population. A large portion of them would soon be in clerical and administrative occupations. In this case, it seemed advisable to use the industrial standard covering desk jobs even though the resulting rate of failure would be unusually high.

This covers the development of the school standards for the Ortho-Rater tests. If you study the three standards, you will recognize a familial resemblance. It is interesting to note that the changes with advancing school levels might well be attributed to growth or increase in ability.

For the past two and one-half years we have been using these standards to process the school records received at the Occupational Research Center. After analyzing an additional 100,000 of these records we are convinced that our standards are well validated. While there is considerable variation in the failing rate from school to school, the total picture suggests that about 30% of the school population could benefit by eye care. We also find that less than five per cent of the school children wear glasses. It appears that we have here, a rather huge population that has been neglected in our drives for better vision.

There have been concerted efforts to correct these problems in several areas. Recently we have run a full analysis of findings in one large school system with a strong vision program functioning for three

school terms. Because of the number of children covered in this single area, we feel that many conclusions may be drawn from this sample.

The study in question covers more than 14,000 children in a single school system. The schools covered were urban, rural and suburban and included children in grades one through twelve. There is apparently considerable variation in the population of this area in view of the variations in visual ability. The failing rate varied from 58.8% in one small school to 15.4% in a large school with a second year vision program. The reasons for failure also varied from school to school. The most interesting picture however is the broad view.

Of this entire group 30.6% failed to meet the school standard for acuity (4.2% were seriously lowered). An additional 7% failed to meet the phoria requirements of the standard. From the acuity standpoint, distance and near acuity seemed to be about equally weighted: 10.8% fail distance and near. 8.8% fail distance only. 8.9% fail near only. The correlation between the findings for both eyes at distance and near was .575.

It is also interesting that 2% fail worse eye at distance after passing the both eyes test.

These findings would certainly seem to indicate the need of tests at both distance and near. Use of monocular tests is also definitely warranted.

After completing our analysis of the causes of failure of this large group of children we began to investigate other trends. Several years ago, the Department of Ophthalmic Research & Development at Bausch & Lomb did considerable work on school vision. At that time, our populations were somewhat limited and we hesitated to propound conclusions. There was at that time, however, a definite evidence of a vision trend by grade. When the Occupational Research Center was at Purdue, the workers there were impressed by the high failing rate in the primary grades and established the practice of failing below grade four only if the child had failed the basic health standard (Ortho-Rater acuity score of 4 or Snellen equivalent of 20/50 or lower). We have departed from this procedure somewhat since early broad school studies at B & L indicated that a score of 6 (20/33) might be more adequate in light of the present study. A primary standard has not been included in our school standards because of certain problems inherent in testing. We feel that special attention must be given to these records to insure valid referral. Frankly, we would prefer to process these records.

In spite of the fact that the cutting scores have been set to fail the lowest 10 to 15% on each test, we must note that the total failing

rate on the various acuity tests reaches 30% with the cause of failure fairly evenly divided between distance and near skills. This rate of failure seems quite high yet it is not excessive in view of previous studies. It is also interesting that there has been no complaint of over-referral in this area. Apparently the eye men have found a definite need for their services. It would be interesting to follow this same population after eye care had been obtained; however, at present it seems advisable for the program to be extended into areas not yet tested. Eventually we may be able to evaluate the outcome of the referral program.

Now, to project these findings. In the entire country there are approximately 30 million children aged 5 to 17 in the public schools. An additional two million are in trade schools and colleges. We should also probably consider the more than 16 million children under school age for these youngsters will be added to the school population during the coming five years. Our experience indicates that close to one-third of these children would probably benefit by eye care. This would indicate that there are about ten million youngsters in the schools who need your help for their present and future efficiency and comfort. Each year approximately one million new cases will be added to the original estimate.

REFERENCES

1. Boynton, Ruth E.
Variations in Visual Acuity Among College Students.
Sight Sav. Rev. 6:263-273, 1936.
2. Collins, S. D.
The Eyesight of the School Child as Determined by the Snellen Test.
Publ. Health Rep. 39:3013-3027, Nov. 28, 1924.
3. Glover, L. P., and Brewer, W. R.
An Ophthalmologic Review of More Than 20,000 Men at the Altoona Induction Center.
Am. J. Ophth. 27:346-348, 1944.
4. Gover, M., and Yankey, J. B.
Physical Impairments of Low-Income Farm Families.
Publ. Health Rep. 59:1163-1184, Sept. 4, 1944.
5. Kempf, Grover A., et al.
A Special Report of the Vision of School Children.
Pub. Health Rep. 43:1713-1739, July 6, 1928.
6. Kuhn, H. S.
An Appraisal of Visual Defects in Industry.
Trans. Am. Acad. Ophth. & Otol., May-June, 1941.
7. McDonald, C. J.
One Phase of Eye Work in the Navy.
Optom. Weekly 35:347-348 and 373-376, 1944.
8. Parnell, R. W.
Sight of Undergraduates—Loss of Visual Acuity.
Br. J. Ophth. 35:467-472, Aug., 1951.
9. Thacker, E. A.
A Study of Ocular Defects Among University Students.
Am. J. Ophth. 22:1003-1011, 1939.
10. Theodore, F. H. (Capt.), et al.
Causes of Impaired Vision in Recently Inducted Soldiers.
Arch. Ophth. 31:399-402, May, 1944.

PRELIMINARY REPORT ON THE DIAGNOSTIC EFFICIENCY OF THE SECOND EDITION OF THE DVORINE PSEUDO-ISOCHROMATIC PLATES*

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The purpose of this investigation was (1) to note the percentages of males and females who fail to pass this test when it is administered in a well-lighted room, without the use of a special daylight illuminant; and (2) to record the plates that are not identified by individuals with normal color discrimination ability as well as the plates that are identified by those who fail to pass the test.

The term normal is applied here to any individual who identified 12 of the 14 plates of the first section of the test. Plate 1 is not included in this number, for it is a demonstration plate and is visible to the normal and to the color-blind.

The terms color-blind and color deficient are applied to individuals who failed to identify 3 or more plates of the first section of the test.

These figures, for the normal and color deficient, were established as a result of a previous sampling (unpublished) by the writer, who found that individuals with normal color discrimination ability had no difficulty in passing this test, with the exception of an occasional chance error on one or two plates. It was also found that color deficients (identified as such because of their failure to pass other available color tests) generally failed to identify all of the 14 plates, with occasional chance recognition of one or two plates.

The testing room was 12 feet by 15 feet, with a central light suspended from the ceiling, containing a 200-watt clear white mazda bulb enclosed in a white translucent globe. The patients sat in the ophthalmic chair and the plates were illuminated by an additional light attached to the arm of the chair. This light consisted of a 100-watt blue daylight frosted mazda bulb.

In each case the visual acuity was taken and was known to be sufficiently high to pass the color test, providing color discrimination was normal.

This report is confined to the investigation of the color vision of

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TABLE 1. RESULTS OF TESTING

	Males	Females
Number tested	112	100
Passed 100%	98	99
Passed but failed to identify 1 plate	2	0
Passed but failed to identify 2 plates	0	0
Failed 100%	10	0
Failed but identified 1 plate	1	0
Failed but identified 2 plates	1	0
Failed but identified 3 or more plates	2	1
Total percentage of failures	12.50%	1%

112 males and 100 females, their ages ranging from 7 to 68 years. Table 1.

The number of males who failed the test is higher than expected. The writer believes that this may be due to the fact that he is known in his community for his interest in color vision and that the number of color-blind patients who consult him is probably greater than is generally found in the average optometric practice.

IMPORTANCE OF LOW MISCLASSIFICATION

Dr. Louise L. Sloan[1] pointed out that the "ideal test is one in which normal individuals make relatively few errors, and the range of error scores of color deficients is sharply differentiated from that of normal subjects." Table 2 shows the percentages of normals failing and color deficients passing each of the 14 plates used in this test. Table 3 shows plates failed by subjects who passed the test.

Patient #139, L.P., in Table 4, received training in color discrimination during the past war. He claimed that he had no difficulty in

TABLE 2. PERCENTAGE RATES OF MISCLASSIFICATION

Plate Number	Normal	Color Deficient
	212	15
2	0	.066
3	.009	.066
4	0	.133
5	0	.133
6	.014	.133
7	0	.133
8	0	.066
9	0	0
10	0	.266
11	0	.2
12	0	.066
13	0	.066
14	0	.133
15	0	.133

[1]Sloan, Louise L.: "An Improved Screening Test for Red-Green Color Deficiency Composed of Available Pseudo-Isochromatic Plates," Journal of the Optical Society of America, Vol. 35, No. 12, 761-766, December, 1945.

TABLE 3

Specific plates failed by normals who passed the test

Case Number	Normal Patient	Plates 2	3	4	5	6	7	8	9	10	11	12	13	14	15
66	R.H.*					x									
94	A.W.*					x									
120	H.F.N.*					x									
159	R.J.		x												
185	A.B.		x												

*Patients R.H., A.W., and H.F.N. identified plate #6 as 96 instead of the correct 95.

TABLE 4

Specific plates identified by color deficients who failed the test

Case Number	Color Deficient Patient	Plates 2	3	4	5	6	7	8	9	10	11	12	13	14	15
13	P.D.														
16	J.A.														
17	I.A.*						x	x			x	x		x	x
40	R.S.														
60	J.K.														
62	S.G.														
96	M.F.									x				x	
100	M.K.														
102	R.B.B.														
117	L.A.P.														
139	L.P.*			x	x	x				x	x				
175	A.K.									x					
200	R.M.*	x	x	x	x	x				x	x		x		x
206	F.C.														
208	C.W.														

*Patient #17, I.A., was the only female in the group to fail the test. Her nomenclature for colors was correct and she was classified as mildly color deficient. She is the mother of patient #16, J.A., who failed to identify all the plates.

passing several color vision tests while he was in the service.

Patient #200, R.M., also in Table 4, was classified during World War 2 as mildly color deficient.

SUMMARY

1. A preliminary report is presented of 112 males and 100 females, ranging in ages from 7 to 68 years, who were tested for color-blindness with the second edition of the Dvorine Pseudo-Isochromatic Plates.

2. Of this group, it was found that 14 males (12.5%) and 1 female (1%) failed to pass the test.

3. The relative diagnostic value of each plate has been tabulated and the percentages of misclassification was shown to be low.

4. An important point in this study is the fact that all patients were examined in a light environment closely resembling the average refracting room, without the use of a special daylight illuminant.

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THE RELATIONSHIP OF SCHOOL ACHIEVEMENT AND VISUAL ANOMALIES*

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We are this year celebrating the anniversary of a great university, the central theme of this celebration being "Man's Right to Knowledge and the Free Use Thereof." It is most appropriate that on this occasion and as part of this celebration we consider the role of vision in the acquisition and utilization of knowledge—the theme for the present series of seminars. The specific part of the topic which we shall discuss is the relationship between learning and the visual apparatus of the individual. Specifically, we shall concern ourselves with (A) the effect of visual anomalies on learning; (B) the effect of use of the eyes in learning, on anomalies of vision; and (C) what can be done both to enhance learning and to decrease the prevalence of visual anomalies.

Before beginning to examine the evidence for the relationships, we should in a general way clarify and define terms which will be used. On the learning side of the picture there is no problem since most people have some knowledge of reading ability and school achievement as measures of learning. Visual anomalies are sufficiently complex and misunderstood to merit some discussion.

For efficient binocular vision, two general conditions must be met. Each eye must see clearly, and the two eyes must point at the object being viewed. Since the position of the eyes is determined by the action of the six muscles which attach to the eyeball itself and to the bones of the orbit, anomalies of this latter sort are usually referred to simply as *muscular imbalances*. We are concerned, then, with the clearness of seeing and with muscular balance or imbalance.

Clearness of vision depends upon (1) the structure of the eye, (2) the clearness of its parts, and (3) the integrity of the nerve elements which link the eye to the brain. Fortunately, in children, only anomalies of structure are common. Thus, the eyes may be so constructed as to not form a clear image of an object which is some distance from the observer. One such imperfection is nearsightedness, a condition in which distant objects appear blurred or distorted.

The eye, at least during early life, is capable of changing its focus

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to some degree. This is accomplished by the action of a muscle within the eye. Farsightedness is an anomaly in which, were it not for this muscle, distant objects would be moderately blurred and near objects very blurred. However, the young person with moderate amounts of farsightedness can see clearly at all distances, but in so doing must perform a greater amount of muscular work than his more nearly normal brother. This excessive muscular work is more marked in viewing near objects than in viewing distant ones.

Muscle balance and imbalance may also be simplified. It has been stated that the eyes must both point at the object of regard in order for a single percept to be obtained. If the anomaly is severe, then the child is said to be cross-eyed or wall-eyed. However, it is possible and much more usual to have a visual apparatus so constructed and innervated that a tendency to turn exists but in which this tendency, by appropriate muscular action, is overcome. Thus, a child may have eyes which tend to turn inward too far, but he may possess a muscular set-up which enables him by performing work to move his eyes outward and direct them at the object. To be sure, this is not done consciously, but it nonetheless represents work done. It should now be stated that the tendency to deviate may differ at different distances. Finally, it should be stated that the most common imbalances would be those of a tendency to deviate inward or outward.

While the above discussion is superficial and has included only the most common anomalies, it should serve as background for the ensuing discussions.

(A) EFFECT OF VISUAL ANOMALIES ON LEARNING.

The various visual anomalies form a continuum ranging from the slightest deviation to the most marked. With regard to clarity of vision, at least, it is clear that the most severe of the anomalies, blindness, has a marked effect upon learning. The widely used teaching aids such as blackboard presentation, projected material, maps, charts, pictures, and books will be of no value to such a student. Whether or not such a loss will materially reduce learning will be covered by another speaker in this seminar, but we may note that it will at least alter learning. We shall concern ourselves here with the less severe anomalies and their effect upon learning.

Most of the studies which have been made in the past and which concern the two variables being considered, have used reading ability as a criterion of learning, although a few have used measures of school achievement. This literature has recently been reviewed and evaluated by Robinson[1], and a group of recent studies by Robinson and her co-

workers[2] forms the basis of the present section.

In most studies, a comprehensive series of visual tests was performed along with tests for reading ability and school achievement, and, almost universally, an absence of relationship between vision and learning was demonstrated. Thus, Dalton[3], after studying 5,000 school children, concluded, ". . . there is little, if any, general relationship between normal or defective vision and scholastic achievement." Betts and Austin[4] after a careful study of 109 school children concluded that "there appears to be no significant relationship between achievement in reading . . .. and the summation of the visual factors appraised in this study." Bledsoe,[5] for 293 children, found relationships between visual defects and reading which were "unreliable but suggestive." Bender and co-workers[6] found "no significant relationship between efficiency of vision and college grades."

This absence in relationship between school achievement or reading and visual defects has been the usual finding in general studies. Yet it seems so obvious that a child with visual defects should be handicapped in learning. What is the reason for this seeming paradox? One possible explanation is that there are few poor readers in a random sample; correlation techniques in a restricted sample will tend to obscure or minimize any relationship. However, Bird[7] compared the visual status of a group of high achievers or good readers with one of low achievers or poor readers and found no difference between them. A second possibility is that raw scores of reading achievement should not be used but rather that the reading score should be considered relative to what the child could do as determined by his mental age. Park and Burr[8] performed 14 visual tests and scored each failure as one point, thereby setting up a scale of visual capacity from zero (no tests failed) to 14 (all tests failed). When these scores were correlated with reading performance, the coefficient was near zero and did not differ significantly from zero; when, however, the reading score was divided by the mental age, yielding a ratio of relative achievement and when these ratios were correlated with visual scores, then a significant correlation coefficient was obtained ($+0.465 \pm 0.040$). There may be other reasons for the existence of this relationship, but it does suggest that if visual defects are associated with learning, they are associated with potential or relative learning scores rather than with absolute achievement.

A third possible reason for the absence of relationship between learning achievement and visual status in general studies may be that by combining all visual defects, relationships between single items in the battery of visual tests and reading achievement are obscured. Cer-

tainly, some of the visual attributes will be more directly involved in the reading process and in learning than others. Eames[9], for example, found that far-sightedness and one form of muscle imbalance (exophoria at the reading distance) were more common among groups of poor readers than among groups of good readers. Although Robinson[2] has pointed out certain statistical weaknesses in the Eames study, these findings are nonetheless suggestive. In order to attack this problem, Robinson and Huelsman[10] administered 59 different visual tests to a group of children along with ten reading tests and tests for mental age and intelligence. Correlation techniques yielded no significant results. The authors chose from the group the ten pupils who were reading nearest to their intellectual levels (reading scores compared to intellectual expectancy) and the ten who were the lowest achievers (poorest readers relative to their intellectual expectancy). For these two groups, the results of 13 of the 59 tests were markedly different. The authors checked to find which tests consistently differentiated the high from the low achievers and finally found five who did so. The authors concluded the following:

> It is significant that the only visual scores which consistently differentiated high and low achievers . . . involved binocular visual performance. Furthermore four of the five utilized convergence and divergence skills.

In summarizing the effects of visual anomalies upon school performance, it may be said that although many studies have failed to show any relationship, this was probably due, partly, at least, to the criteria of achievement and of visual defects. It would seem that relative achievement is related to specific visual functions, particularly muscle imbalances, but that this relationship becomes obscured in general studies.

A closer study of the type of visual anomaly with which we seem to be dealing here should be of value. Reading, (and, hence, learning) difficulties seem to be associated with hypermetropia (farsightedness) and with muscle imbalance particularly at the near point. What is the nature of these anomalies, and why should they prove obstacles to learning to read?

In the earlier discussion of visual anomalies it was stated that the farsighted child could see both distant and near objects clearly but that he accomplished this by doing an excessive amount of muscular work, particularly when observing close objects. It is not difficult to understand, therefore, why such a child might avoid reading. The nature of the physiological reaction to excessive use of this muscle is among the many fascinating and partially unsolved basic problems, but need not concern us here. Whether pain and discomfort are due to piling up of metabolites at the muscle itself or are of neurological origin is

important, but we need not wait upon its solution. Clinical observations of farsighted children show that they have discomfort when reading, develop an aversion to reading, and tend to compensate in other ways: occasionally, they are unable to maintain the print clear for long periods of time, and this may be mistaken for a short or poor attention span. A personal experience with two such children will demonstrate the clinical picture in its extreme form.

In 1948 we performed a vision survey at one of the grammar schools in the vicinity of The Ohio State University. The first day the school nurse stated that there were two boys in the group who had adequate intelligence but were doing poorly in school and were, moreover, a behavior problem since they spent most of their time disturbing the other children during class time. The nurse had done a cursory vision examination and had found that both boys were able to read the prescribed letters on the chart. She asked us to see if we could find the two. We found two boys who had exceptionally high degrees of farsightedness,* and these were the two about whom the nurse had spoken. It should be clear that in citing this story, we do not wish to imply that the possible cause of all behavior problems may be as dramatically discovered, nor that any fixed percentage of children with behavior problems are farsighted. It does, however, show the clinical picture of marked degrees of farsightedness. Although Robinson and Huelsman did not mention the relationship between farsightedness and reading disability, it seems to be well-established, at least so far as high degrees of farsightedness is concerned. The basis seems to be the excessive work required of such children to read.

With regard to muscle imbalances, the same sort of situation is present. A child whose eyes tend to deviate and who can bring them into alignment seemingly does so at some expense. Robinson and Huelsman did find that of the 59 visual tests which they did, only five differentiated the poorest readers from the best, and that four of these were tests for muscle balance at the near distance. If the child has a severe muscle imbalance, and the eye actually turns, or if only one eye sees at a time, there is not as much difficulty as when it is possible by neuromuscular activity to rectify the undesirable tendency. This is one of those odd situations where the moderate anomaly may cause more trouble than the severe one.

We have thus far discussed those anomalies which may cause difficulty in reading: nothing has been said about nearsightedness. It will be recalled from the earlier discussion that the nearsighted child is one who can see near objects clearly, but not distant ones. Such a child

*The degree of hyperopia for these two boys was +5.00 and +7.00 D.

will probably not become a reading problem because of his eyes. However, in the broader concept of learning, such a child is handicapped. He cannot see the blackboard or other visual teaching aids clearly. The anomaly of such children is readily discovered by their parents, the school nurse, or by themselves; and because of the obvious nature of the anomaly, the fact that the child cannot see, corrective measures are almost invariably instituted early enough so as not to affect learning. Because of this, we sometimes lose sight of the fact that distance vision is important in learning, especially in our modern society.

From the foregoing it should be clear that certain of the visual anomalies are decidedly related to learning and can impair the child's learning. Some of these anomalies interfere with the child's ability to learn to read, others with his ability to clearly see material presented on the blackboard and projection screen. In simplifying, we may have given the impression that the anomalies we have discussed were the only ones to which we human beings are heir. This is not the case, but those we have discussed are the most prevalent and the most clearly associated with the learning process. It is also hoped that we have not given the impression that all learning problems stem from visual anomalies. On the contrary, as we stated earlier, in most random samples, investigators have had difficulty in demonstrating any relationship at all. It is only with recent advances in thinking along these lines that some of the relationships have begun to be observed.

(B) EFFECT OF THE LEARNING PROCESS ON THE DEVELOPMENT OF VISUAL ANOMALIES.

Although the effect of visual anomalies upon learning is readily studied, the effect of reading and use of the eyes upon vision is not easily subjected to experimental proof. To be sure, most people are certain that excessive use of the eyes will cause difficulties, but despite the universality of this belief, the evidence is not clearcut. What we are dealing with is one aspect of a very old controversy, that of the relative importance of heredity and of environment. The solution of the nature-nurture problem in most biological problems seems to rest upon both having an effect, and the problem reduces itself to one of determining the relative importance of each.

The anomalies of vision may be considered separately. Farsightedness is present at a very early age. The classical theory is that children are born farsighted and during the early years of life become less so. Within the past 20 years, evidence has been piling up to support the view that farsightedness develops during the first six years of life and, particularly, during the first year. However, even if this is the case, the anomaly is clearly established before the child begins his formal learning

in school, and, thus far, no one has claimed that use of the eyes affects farsightedness.

Nearsightedness, on the other hand, is an anomaly which is present before the sixth year only rarely and which develops between the sixth and eighteenth year, often increasing in degree at an alarming rate about the time of puberty. It is, therefore, not surprising that early investigators should have linked this anomaly to the effect of school work. As early as 1860 Cohn[11] of Germany had postulated use of the eyes in close work as the major, if not the sole cause of nearsightedness. Cohn examined 10,000 school children and noted the absence of this anomaly when the child entered school and its prevalence among children in the higher grades. Since that time, the so-called use-abuse, or environmental, theory for the development of nearsighteness has been a major one. More recently, a theory, usually termed the biological theory, has come to the fore and is still in the process of undergoing minor modifications. In essence, this theory postulated that the development of nearsightedness is a growth phenomenon not particularly affected by the use of the eyes. In 1946 Stenstrom[12] of Sweden perfected a technique which utilized X-ray and measured the various dimensions of the eye. He proved conclusively that, for the most part, nearsightedness rested upon an undoubtedly long eyeball. This, of course, has lent support to the biological theory since it is not readily apparent how use of the eyes could cause them to grow larger. In our own research,[13] using large, unselected samples of school children, we have been able to demonstrate that nearsightedness appears earlier in girls than in boys and tends to develop during or just prior to the second major growth spurt, i. e., that occurring about the time of puberty. The evidence seems to be pointing to nearsightedness as a normal growth phenomenon in some children, and an abnormal growth phenomenon with possible hormonal correlates in others.

To review the evidence for and against each of these theories would take more time than is available to us. It is my opinion after some study of the problem that the evidence favors the biological theory and that the appearance of nearsightedness during the school years is coincidental rather than caused by use of the eyes. In the absence of critical studies, we can only examine and evaluate existing evidence.

With regard to the muscle balance of the eyes, it would seem that these do change with use of the eyes. Certain of the muscular functions may be altered, and it is this fact which forms the basis for one important branch of optometry today, namely orthoptics, or visual training. Specifically, the ability to turn the eyes inward even in the presence of a tendency toward outward deviation may be trained. There is some

evidence that these functions are affected by use of the eyes. The degree of relationship has not been established, and one of the present frontiers in optometric research is the determination of the effect of use upon certain of the neuromuscular functions. It should be pointed out, however, that there is also evidence that others of the neuromuscular functions are not changeable and are innate.[14] As the eye changes its focus, there is innervation to the muscles turning the eye, and the amount which the eye turns for each unit of alteration in focus seems to be constant throughout life.

In summarizing the effect of learning upon visual anomalies, it must be stated that the evidence at present is far from complete. While use of the eyes may certainly cause temporary discomfort, there seems to be no conclusive evidence for any far-reaching alterations or for the development of series anomalies. On the contrary, when we consider the delicacy of the structures involved and the fineness of the neuromuscular relationships, we are amazed at the ability of the visual apparatus to successfully withstand use and misuse. If use of the eyes causes any change at all, it is probably in certain of the neuromucular relationships or reflexes. Certainly, in the field of orthoptics, the best results have been obtained in attempts to alter these.

(C) TOWARD THE FUTURE.

In the light of the foregoing, we may now consider what can be done to enhance learning and to decrease the prevalence of visual anomalies. Since reading disabilities sometimes have a visual basis, it would seem that any child having difficulty in learning should have a careful visual examination. Since these difficulties are sometimes associated with muscular imbalances, it should be clear that merely an examination of the child's ability to read a chart is not sufficient. Ideally, every child should have a complete visual examination at about the time of entering school, but in the absence of this, at least those exhibiting reading difficulties should be tested. There are numerous visual tests of varying degrees of complexity on the market which may be used by school nurses and lay personnel. In this connection, it should be pointed out, however, that Robinson and Huelsman,[10] in discussing those tests which differentiate good readers from poor readers, have stated, "Not one of the current visual screening batteries includes these tests." Perhaps in the future, tests of this sort will be included in screening batteries. Time alone will tell whether or not this is feasible. In the case of farsightedness, almost the same conditions prevail except that some of the screening batteries in use at present attempt to discover farsightedness. Nearsightedness, as was stated earlier, is not a major problem since it is easily discovered and readily corrected by the use of lenses. Many of the

muscular imbalance anomalies which may interfere with reading are amenable to visual training and other optometric procedures. Insofar as enhancing learning is concerned, the problem is more one of detecting the anomalies than of treating them. Insofar as the effect of learning and use of the eyes on the development of visual anomalies is concerned, it has been pointed out that there is no clear-cut evidence for any effect. To be sure, it would seem pedigogically sound to follow various visual hygiene procedures and avoid temporary discomfort. Such factors as proper illumination of the room, proper reading distances, etc., will guard against visual discomfort. However, insofar as the production of visual anomalies due to use or misuse of the eyes is concerned, there seems to be little cause for worry.

Finally, throughout this paper, we have indicated the direction in which research is at present moving. It is only fitting that on an occasion like this we should conclude by pointing out both the contribution in research which universities like Columbia have made in the past and our dependency upon them for further advances in the future.

REFERENCES

1. Robinson, Helen M. Why Pupils Fail in Reading. Univ. of Chicago Press, Chicago, Ill. pp. 7-33, 1946.
2. Robinson, Helen M. (Ed.) Clinical Studies in Reading II Supplementary Educational Monograph No. 77, Univ. of Chicago Press, Chicago, Ill., 1953.
3. Dalton, M. M. A visual survey of 5,000 school children. Journal of Educational Research, 37:81-94, 1943.
4. Betts, Emmett A., and Agnes Sutton Austin. Visual Problems of School Children, Professional Press, Inc., Chicago, Ill., 1941.
5. Bledsoe, An Analysis of the Relation of Auditory and Visual Defects in School Achievement and Other Factors. Master's paper, University of Georgia, 1940.
6. Bender, Irving E., Henry A. Imus, John W. M. Rothney, Camilla Kemple and Mary R. England. Motivation and Visual Factors. Dartmouth College Publications, Hanover, New Hampshire, 1942.
7. Bird, Lois E. A study of certain visual characteristics of high and low achievers in reading at the fifth grade level. Master's Thesis, Pennsylvania State College, 1939.
8. Park, George E. and Clara Burr. The Effect of Eye Abnormalities on Reading Difficulty. Journal of Educational Psychology, 34: 420-430, 1943.
9. Eames, Thomas H. Comparison of eye conditions among 1,000 reading failures, 500 ophthalmic patients, and 150 unselected children. Am. J. Ophthalmology, 17:324-325, 1935.
10. Robinson, Helen M. and Charles B. Huelsman, Jr. Visual Efficiency and Progress in Learning to Read. Chapter 2, in Reference 2, above.
11. Cohn, Hermann, Untersuchungen der Augen von 10060 Schulkindern nebst Vorschlangen zur Verbesserung der den Augen nachteiligen Schuleinrichtungen. Leipzig, 1867.
12. Stenström, Sölve Untersuchungen über die Variation und Kovariation der optischen Elemente des menschlichen Auges. Acta Ophthalmologica. Supplementum 26. Copenhagen, 1946.
13. Hirsch, Monroe J. The changes in refraction between the ages of 5 and 14—theoretical and practical considerations. Am. J. Optom. and Arch. Amer. Acad. Optometry. 29:445-459, 1952.

Note: References 3 through 9 were all cited in Reference 2. The original papers were not consulted.

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A SPIRIT OF INQUIRY

Rather frequently the remark is made that so and so has not cracked a book since the day he graduated from college. Such a remark is not an indictment that the person in question has ceased to learn; no, it only is an indication that one of the most important and best developed aids or tools of education no longer is utilized. Usually the remark is not used in its literal sense but only by implication. What is meant is that a person is content with his *status quo;* he is not interested in keeping abreast with scientific and professional advancement; in short he is willing to rest on his oars.

Practitioners do not have a monopoly on this attitude; it also is found in the faculties of schools, colleges and universities. Even members of the regular teaching staff desiring qualifications on the graduate faculty of a university sometimes espouse this point of view. In these instances, however, it usually is manifest either by indifference or an

unwillingness to personally participate creatively in the fine arts or research and investigation in the sciences. Such individuals often have done no research beyond that required for the doctorate dissertation. As a result they have not "cracked" the volumes of knowledge inherent in every aspect of nature since the day they graduated.

More often than not, the attitude described above results from a misconception of the meaning and significance of education and degrees. Education only helps a man to meet the challenges of life: the formal part of it only consumes four or five years; the informal portion lasts forty or fifty years. Essentially there is not and actually there should not be any break between the two. The one leads continuously into the other and if differing in any way it only is in degree or rate. Simularly, a degree does not represent an end or terminating point; it is only a mark, a milestone, in the educational path through one's professional life. Correctly conceived, a degree signifies *an ability to perform at a certain level of competence at a given time.* It cannot mean anything more.

There is no law that requires a man to operate at his maximum potential. We all know optometrists who chose not to practice optometry but perhaps prefer to engage in other activities or even teach school. In the same way some recipients of advanced degrees in physiological optics prefer practice of optometry to teaching and research in vision.

It is lamentable for society when individuals do not measure up to their full responsibility and ability. In all cases, without the product from maximum competence of each person or group, retrogression of some measure is present. Everyone of right mind abhors moving backward. The result of it invariably leads to a weakening of the social structure; fear, insecurity, lack of confidence in the future all are a natural consequence.

Failure to make progress in optometry is just as real as retrogression in the economic system of our country. It is present whenever individual members of the profession and thus the profession itself are not measuring up to their full ability and potential; it is present whenever a person or group experiences a loss of confidence in itself; it is present whenever one looks back and longs for the "good old days" rather than the forward vision to the growth, development and future of the profession. The spark, the incentive for this growth is a spirit of inquiry. A desire to know, to understand, to appreciate, to contribute what one is able. All are facets of this approach. If it is followed, it will lead to confidence, a positive attitude and enable one to be forthright and justly proud of a vigorous forward moving profession.

Next December, in Chicago, your Academy will launch post-

graduate courses in conjunction with its annual meeting. All of them will be short in duration; most of them will be complete in one or two hours; a few will be as many as six hours in length; only one or two will be as long as twelve hours. It is a hope to have as many as forty instructors and perhaps sixty courses offered during the three days prior to the regular annual meeting. The courses and the instructors will be carefully chosen; all the instructors will have made a detailed and careful study of the subject material of his course or already be a specialist in his own right.

The postgraduate courses provide you the opportunity of substantially contributing to the prosperity of optometry through self improvement. Why don't you encircle the dates of December 7 - 12 on your calendar now and without fail attend as many postgraduate courses as possible as well as the regular annual meeting of the Academy?

V. J. Ellerbrock*

*Chairman, Committee on Instruction, American Academy of Optometry.

TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

DR. J. I. PASCAL DIES IN NEW YORK CITY

Dr. Joseph I. Pascal, 65, died at Manhattan General Hospital, New York City, April 22, after a short illness. Dr. Pascal, internationally known as an optometrist and ophthalmologist, made many valued contributions to the science of ocular refraction. During a busy lifetime he had served on the faculty of the Massachusetts College of Optometry and the School of Optometry, Columbia University. Because of his contributions to the literature both here and abroad and his frequent lecture engagements, Dr. Pascal was known to optometrists in all parts of the world. Just before his death he was scheduled to speak before the New York Academy of Optometry.

Dr. Pascal was founder of the American Institute of Optometry in 1914 and was its director until 1927.

Dr. Pascal has for years been active in the American Academy of Optometry and Academy members everywhere mourn his passing.

NEW MEMBERS OF THE ACADEMY

The following scientist and optometrists have been elected to Fellowship in the American Academy of Optometry. The Academy welcomes these new members.

Dr. E. H. Bordwell, Gas & Electric Bldg., Dayton, Ohio.

Dr. Brian J. Cox, R.O., 611 Columbia St., New Westminster, British Columbia, Canada.

Dr. Gordon W. Duffy, 431 N. Irwin St., Hanford, California.

Dr. Stanley C. James, R.O., 564 Second St., Medicine Hat, Alberta, Canada.

Dr. Jean Jolin, R.O., 198 St. Joseph, Waterloo, Quebec, Canada.

Dr. Hollis M. Leverett, Research Department, American Optical Company, Southbridge, Massachusetts.

Lt. Eugene W. Nirk, USAF., (MSC), 7100th USAF Hospital, A.P.O. 633, c/o P.M., New York, N. Y.

Dr. Jack A. Ryde, R.O., 125 Holland Ave., Ottawa, Ontario, Canada.

Dr. Albert C. Stoltze, 804 Clement St., San Francisco, California.

Dr. A. D. Venuto, 1548 E. Passyunk Ave., Philadelphia, Pennsylvania.

SECOND WESTERN REGIONAL ACADEMY MEETING

More than one hundred members and guests of the American Academy of Optometry attended the Second Western Regional Meeting April 16 and 17 in Founders Hall at the University of Southern California.

The scientific papers presented provided significant contributions to the field of Visual Science. A write-up in the LOS ANGELUS SUNDAY TIMES indicated the interest of the general public in the papers entitled, "Factors Effecting Reading Achievement" and "Visual and Reading Improvement in Industry," by Dr. S. E. Herr, of the University of Southern California, and Dr. Howard Walton, of the Los Angeles College of Optometry.

Other papers were presented by George Milkie (student), Melvin Nadell, Ph.D., Henry A. Knoll, Ph.D., Arene T. Wray, O.D., Duco Hamasaki, O.D., Jin Ong, O.D., Elwin Marg, Ph.D., Carol Pratt, O.D., Ph.D., Harry Jankiewicz, Ph.D., Thomas Benitez (student), Robert C. Graham, O.D., Max Schapero, O.D., Meredith W. Morgan,

Ph.D., Bernice C. From, O.D., Merton C. Flom, O.D., Margaret S. Dowaliby, O.D., Edward Goodlaw, O.D., D. R. E. Waters, O.D., Heinz Haber, Ph.D., and George Mount, Ph.D.

The welcoming address was given by Dr. F. Charles Johnson, Chairman of the Southern California Chapter of the Academy, and the main evening address was given by Dr. Meredith W. Morgan, Jr., of the University of California. The next Regional meeting of the Academy will be held at the University of California at Berkeley, some time in April, 1956.

CHAPTER ACTIVITIES

Dr. Barnet Sakler, ophthalmologist, and Dr. John Zettel, optometrist, both of Cincinnati, were the speakers at the March 29 meeting of the Cincinnati Chapter of the American Academy of Optometry. Dr. Sakler spoke on the symptoms and diagnostic signs of glaucoma, and Dr. Zettel demonstrated the Wolfe scleral tonometer. The meeting was held at the Cincinnati Club.

Dr. Gerhard A. Brecher, Associate Professor of Physiology, Western Reserve University, Cleveland, presented his second address on binocular vision before the Northeastern Ohio Chapter of the American Academy of Optometry on April 20 and his third address on this same subject is scheduled for May 18. Meetings are held at the Hotel Cleveland.

CURRENT COMMENTS

Terry Judith Parkins
Editorial Assistant

Optometrists will confer a favor by sending news items of general interest for this department; such as relate to new instruments, clinical techniques, education, visual health and optometric legislation and organization.

SUMMER POSTGRADUATE COURSES IN OPTOMETRY

Summer postgraduate courses in optometry have been arranged on the West Coast at the Los Angeles College of Optometry; in the Central States at the Ohio State University, School of Optometry, and in the East at the Pennsylvania State College of Optometry.

At the Los Angeles College of Optometry the postgraduate courses will run from June 6 through July 1. Courses are given in the morning only during this period. A booklet reviewing the courses may be

had by writing Dr. Frank Brazelton, Los Angeles College of Optometry, 950 W. Jefferson Blvd., Los Angeles 7, California.

At the Pennsylvania State College of Optometry the postgraduate courses will run June 6 through June 10. These courses will extend throughout each day. A booklet reviewing the courses may be had by writing the Pennsylvania State College of Optometry, 12th and Spencer, Philadelphia, Pennsylvania.

At the School of Optometry, The Ohio State University, the postgraduate courses will run July 11 through July 29. These courses will run throughout each day. A booklet reviewing the courses may be had by writing Dr. V. J. Ellerbrock, School of Optometry, The Ohio State University, Columbus, Ohio.

All courses are limited to optometrists.

A WELL DESERVED HONORARIUM

Optometric friends of Dr. Glenn A. Fry, director of the School of Optometry, The Ohio State University, Columbus, Ohio, presented him with an honorarium of $2,000.00 at a surprise party recently held at the home of Dr. and Mrs. Robert Welsh of Columbus, Ohio.

Dr. and Mrs. Glenn A. Fry are planning a European trip this summer and the special surprise gift was presented to the couple to make their trip more enjoyable. Dr. Fry will lecture in Zurich, Switzerland, June 13-15, and at the International Optical Congress in Dublin, Ireland, July 11-15. He has also been invited to present the Foundation Lecture of the British Optical Association.

A.O.A. 58TH CONGRESS EDUCATIONAL SPEAKERS

The speakers at the educational sessions of the annual Congress of the American Optometric Association will be:

Dr. Howard M. Haynes, School of Optometry, Pacific University, Forest Grove, Oregon. His lecture will be "Optometric Reading Problems."

Dr. H. Ward Ewalt, Pittsburgh, Pennsylvania, and Dr. Donald A. Frantz, DeKalb, Illinois. Their lectures will be "Practice Management."

Dr. Maxwell F. Denman, Stuttgart, Arkansas, His lecture will be "Visual Readiness in the First Grade—Are They Ready."

Dr. Raymond Roy, Portland, Oregon. His lecture will be "Ocular Migrane and Heterophoria."

The annual Congress of the A.O.A. will be held at the Schroeder Hotel, Milwaukee, Wisconsin, July 6-9, 1955. Dr. Sam Brown, Fostoria, Ohio, president of the A.O.A. will preside.

All Academy members are urged to attend this 58th annual Congress of the A.O.A. and be present at the Academy luncheon which is scheduled for 12:00 noon Friday, July 8.

A.S.C.O. TO MEET AT CAMP BROSIUS

The Association of Schools and Colleges of Optometry will hold its annual business meeting at Camp Brosius on the two days, July 10-11, following the annual A.O.A. Congress in Milwaukee. Camp Brosius is located in Wisconsin about 60 miles north of Milwaukee. School and College people should make their reservations for accommodations at the camp through Dr. Henry W. Hofstetter, President of the A.S.C.O., director, Division of Optometry, Indiana University, Bloomington, Indiana.

NEWS BRIEFS

Under the new revised Optometry Law of New Jersey it is now a requirement that optometrists in making an examination and refraction conduct the following minimum number of tests, and keep a record of the findings of these tests, for each patient examined. (1) case history, (2) uncorrected visual acuity, monocular and binocular, (3) external ocular inspection, (4) ophthalmoscopic examination, (5) ophthalmometric examination, (6) static skiametric examination, (7) amplitude of convergence and accommodation, (8) distance and near-point phoria and duction findings, horizontal and vertical, (9) subjective examination, (10) fusion findings, (11) stereopsis, (12) color vision test, (13) confrontation visual field test, (14) central field test for patients over 40 years of age, (15) corrected visual acuity, monocular and binocular and the optometrist is required to keep a record of the final formula prescribed for the patient. Under the law the State Board of Examiners may call for inspections, to make sure that these minimum requirements are being followed. . . . Beta Sigma Kappa will hold its annual meeting on Tuesday, July 5, 1955, at the Schroeder Hotel, Milwaukee, Wisconsin. The meeting will start at 9:00 A.M. All members of this fraternity are invited to attend. . . . Mr. Ben A. Ramaker, vice-president of the Bausch & Lomb Optical, has retired after 45 years of distinguished service with the Company. . . . The Maritime Optometric Association has scheduled its annual meeting for Halifax, Nova Scotia, May 22-24. At the educational program, papers will be read by Dr. John C. Neill, Pennsylvania State College of Optometry, Philadelphia; Dr. Robert E. Bannon, Bureau of Visual Science, American Optical Company, Southbridge, Massachusetts, and Dr. E. J. Fisher, dean, Ontario College of Optometry, Toronto. Hav-

ing these outstanding speakers on the program should send a lot of optometrists to Halifax. . . . The A.O.A. held a Four Star Forum in Boston, May 1-2. . . . Dr. Robert Graham, director of research for the Armorlite Lens Company reports the development of a new plastic lens with very high absorption value for ultra-violet and a high transmission of the visible spectrum. . . . School visual screening demonstrations will feature the summer convention of the Indiana Optometric Association June 19-20 at French Lick. Optometrists from Evansville and St. Joseph County will conduct the meeting. . . . Lt. Col. John W. Sheridan, head of the optometry section, Medical Service Corps, U. S. Army, and Dr. Don A. Frantz, DeKalb, Illinois, are the scheduled speakers for the annual meeting of the West Virginia Optometric Association at Parkersburg, May 22-24. . . . Dr. Irving P. Fielderman, Memphis, was a speaker at the April 6 meeting of the Conference of Home Teachers for the Blind at Little Rock, Arkansas. . . . Dr. Glenn Wooters, director of research, Titmus Optical Company, was a speaker at the April meeting of the Optical Society of America in New York City. . . . The Board of Trustees of the New Jersey Optometric Association have requested the A.O.A. to establish a National Fund for Optometric Education to stimulate and receive gifts from corporations. These funds would be used to further develop undergraduate optometric education. . . . Dr. Thomas H. Eames, assistant professor of Education, Boston University, School of Education, Boston, has announced a special course dealing with practical consideration of the part played by physical factors in both normal reading and in reading failure. While the course is designed for teachers, optometrists may enroll. The course (credit three semester hours) will run throughout the Summer Term on Mondays, 7:00 to 9:00 P. M. Dr. Eames is an optometrist and ophthalmologist and is well known as a reading consultant. He is author of the *Eames Eye Test* (World Book Company) as well as numerous research reports on student reading problems. . . . Dr. J. Donald Kratz, chairman, Papers and Program Committee, American Academy of Optometry has issued the "Call for Papers" for the annual meeting of the Academy in Chicago next December. Members wishing to present material should write Dr. Kratz, 158 Washington Avenue, Souderton, Pennsylvania, at once.

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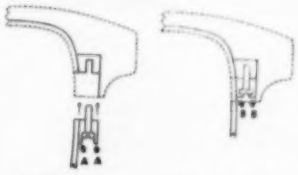

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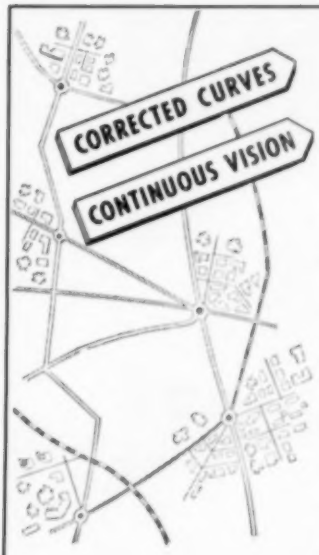

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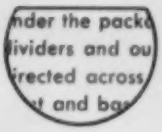

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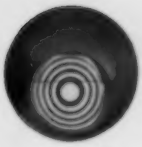

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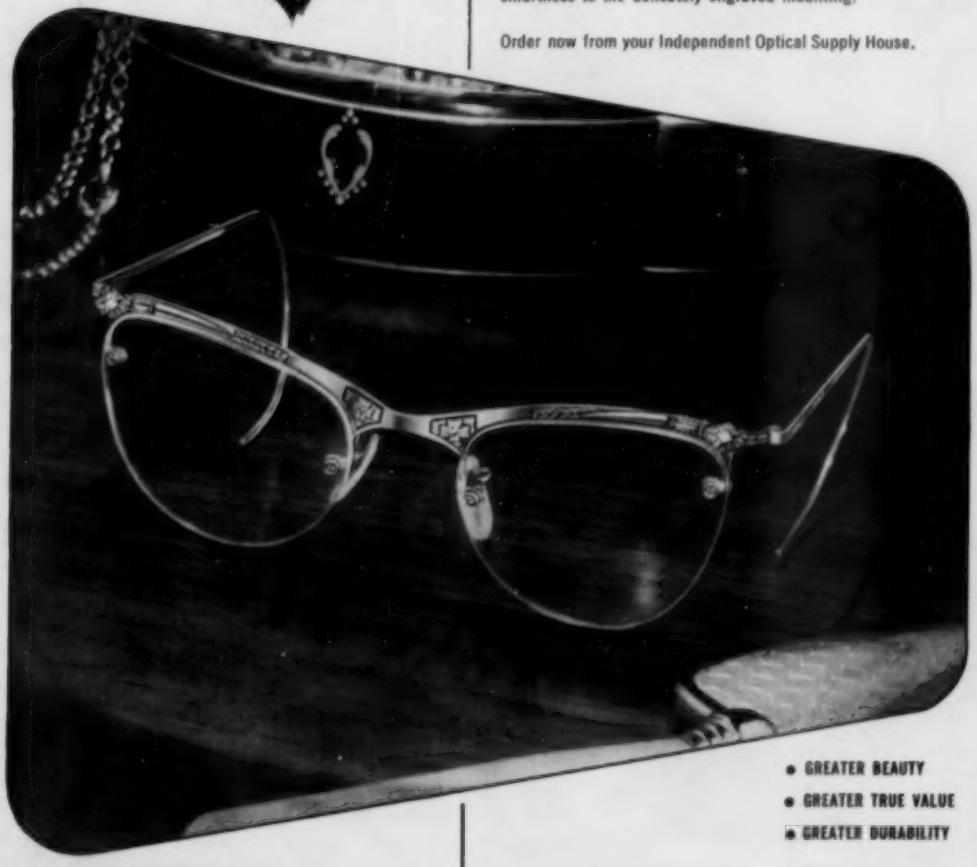

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